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DECORATION

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CONTENTS.

Editorial Summary.
Filtration at the Experimental Station in Lawrence.
The Sulphur Mines in Sicily.
Columbus.
Architecture from a Fireman's Point-of-View.
Restorations in Italy.
Societies.
Communications.
Notes and Clippings.
Trade Surveys.

ILLUSTRATIONS.

The Union Theological Seminary, Park Ave., 69th and 70th Sts., New York, N. Y.
(Gelatine Print issued only with Imperial Edition.)
House and Laundry, Bradford Hills, Chester Co., Pa.
House at Buffalo, N. Y.
Illustrations of a Method of Building with Hollow Walls.

THE SANITAS

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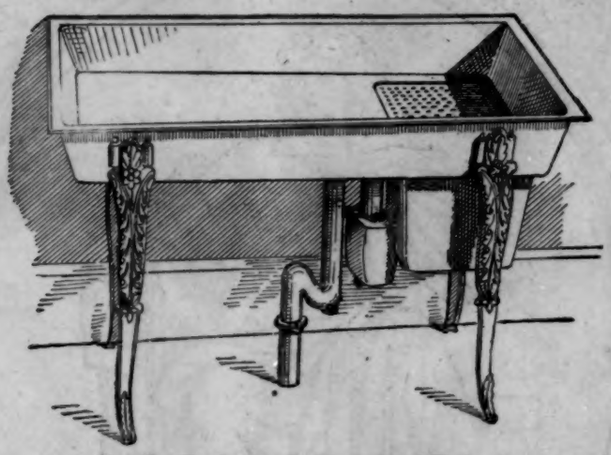

FIG. 45. The Sanitas Kitchen Sink and Flush-pot.

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VOL. XXVI

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CONTENTS

SUMMARY: —

Cohesive Construction. — The Timbrel Arch and the Cohesive Capacity of its Joints. — A Discussion of Legal Decisions cited in a recent Issue. — The Finality of Architects' Certificates dependent on the Terms of the Contract. — The Price of Aluminium and its Effect on Building Fixtures. — — The End of the Great "Copper Pool." — Belgian Builders offering Prizes for Scaffold Designs. 225

FILTRATION AT THE EXPERIMENTAL STATION IN LAWRENCE. . . 227

THE SULPHUR MINES OF SICILY. 229

ILLUSTRATIONS: —

The Union Theological Seminary, Park Ave., 69th and 70th Streets, New York, N. Y. — House of Wm. Hamlin, Esq., Buffalo, N. Y. — House and Laundry for Francis W. Kennedy, Esq., Bradford Hills, Chester Co., Pa. — A Method of Employing Hollow Blocks in Building. 230

COLUMBUS. 230

ARCHITECTURE FROM A FIREMAN'S POINT-OF-VIEW. 233

RESTORATIONS IN ITALY. 234

SOCIETIES. 235

COMMUNICATIONS. —

Blue-printing on a White Ground. — The Supervising Architect. — Books. 235

NOTES AND CLIPPINGS. 235

TRADE SURVEYS. 236

IN connection with the description of the revived "Cohesive Construction," published in our last issue, a few comments might be made. There is no question that the use of our modern cements, which give us the power of binding fragmentary materials together by a matrix far stronger than any except the very hardest of the materials cemented, should long ago have led us to something beyond, or at least, different from the system of building vaults and domes exclusively with voussoirs, designed to maintain their equilibrium without the aid of cementing material, which we have inherited from the mediæval French and English architects, who were entirely ignorant of cements or hydraulic limes, and understood the preparation and treatment of ordinary lime so imperfectly that the mortar designedly counts for almost nothing in their constructions. It is a curious commentary upon the thoroughness with which the mediæval view of a vault, or arch-rib, has been, for the last nine hundred years, impressed upon the minds of students, that to this day there is not a single text-book on applied mechanics or building construction, so far as we know, in any language, which treats an arch as being anything else than a series of independent voussoirs, balanced in various ways, but free to slide upon each other; the effect of the mortar in keeping the voussoirs from sliding being completely ignored, as if it were too small to be considered. It is true that one sometimes comes across a corollary, to the effect that "the mortar in the joints will influence the result in an indeterminate degree," or that "the mortar in the joints may give to the arch, to a certain extent, the character of a coherent mass, so that the result of the calculation, by the system of independent voussoirs, may not precisely express the actual conditions, but the error, if any, will be on the safe side"; but no attempt, so far as we are aware, has ever been made to determine the exact amount of this "error" under given conditions, or, indeed, to investigate in any way the true play of forces in an arch with cemented joints, although in the great majority of arches, at least in this country and in England, the voussoirs are so far from being able to slide one upon another, after the theory of the books, that in many cases the voussoirs will break before they can either be separated at the joints, or made to slide upon each other.

TO regard an arch of this kind as being theoretically identical with an inverted chain is obviously absurd, yet all the mathematical conclusions in respect to arches and abutments which are to be found in the books are, without exception, deduced from this comparison, and the first step toward the formation of a theory applicable to modern arches and vaults has yet to be made. Our older readers have doubtless heard demonstrations that arches of a certain form, with abutments of a certain size, would infallibly fall, and have perhaps, by venturing to suggest that some of the Roman triumphal arches, which were of this form, had stood for two thousand years in defiance of their scientific duty, called down upon themselves the scorn of the lecturer, with the contemptuous explanation that the Romans employed a "concrete construction," which was not amenable to the laws of mathematics. Now, mathematics or no mathematics, we also use habitually a concrete construction, of the same type as that of the Romans, with the difference that ours is still more purely a concrete construction, since our cements are as much stronger and harder than theirs as theirs were than those of the mediævals, and we urgently need, what Señor Guastavino has begun to try to get for us, data and coëfficients in regard to our ordinary construction, with a reasonable theory for their use, which are not derived from the inverted catenary, or the sliding voussoir, but from the actual conditions which exist in brick arches put together with cement. For practical applications of the theory which is yet to be invented, Señor Guastavino appears to have had the sensible idea of going back to the works of the last people who built as we do, namely, the Romans. He found that they built vaults, as do their posterity to this day in Italy, with thin bricks, or tiles, laid flat, and therefore, for a given thickness of vaulting, exposing a far greater surface to the cohesive effect of the mortar. It is easily shown that an arch of a single four-inch ring of bricks of the ordinary size, six feet in span, has about fourteen hundred and forty square inches of joint surface for cementing the parts together; while an arch of the same span, width and thickness, composed of tiles, an inch thick, laid flat, with mortar spread over each ring of tiles before laying the next ring upon it, contains more than three thousand square inches of joint surface, and affords a correspondingly greater hold to the cement on which the strength of the construction depends. It is evident that this method of increasing the effect of the cement in such constructions must modify greatly the resistance to equal and unequal loading, the amount of thrust, and so on, and there is no more curious problem offered to the profession than that of determining the conditions which apply to such arches.

WE suppose that a good many of our readers were interested in the portion of the report of the Committee on Legal Decisions of the Western Association of Architects, which were published two weeks ago from the *Proceedings* of the last Convention of the Association, and a few remarks upon it may not be amiss. The first thing that strikes us is that, although the cases are undoubtedly correctly reported, and very judiciously commented upon, many architects would draw from the report an erroneous idea of the effect of an architect's certificate in general. In the first case, it is mentioned that "the contracts provided that the architect should be umpire, and payments were to be made on his certificate." Although the work was badly done, the architect gave his certificates, and the owner was compelled to pay, the court deciding that the owner, a widow, "was bound to pay the architect's certificate, just or unjust, and, if she had any case at all, she might bring suit against the architect," which she did, and recovered damages. In the second case, in which the contract was similar, we are told that the owner paid all the certificates, "as it would have been useless to contest the payment of any of them," but, on the conclusion of the work, she sued the architect to recover back a part of the money paid the contractor on his certificate, and won her suit.

THE impression which might be conveyed by these cases, that an architect's certificate is always final, and cannot be disputed, would be quite incorrect; and the kernel of the whole matter lies in the provision of the contract "that the architect should be umpire," by which we suppose is meant that the contract contained that foolish, useless and dangerous clause, which was once common in such documents, but is now nearly obsolete, that the decision of the architect should be final in all matters relating to the building. Without this clause, which no architect should allow to be inserted in any contract which concerns him, unless he enjoys learning law at his own expense, the architect's certificate is nothing more nor less than an expression of his opinion that the work has

been properly done up to a given point, and it is open to the owner to controvert this opinion, or to refuse to pay the amount certified to, or to demand deductions, or defend his interests in any way he thinks proper, if he has reason to think that the architect made a mistake in giving the certificate. Of course, the architect ought to be careful not to make mistakes, and as he is the best judge of what has been done, his certificate will have great weight as evidence, but it is not final, and does not bind the owner to pay for what he obviously has not got, unless the contract expressly makes it so. If it does make it so, as the decision quoted shows, the certificate cannot be questioned in court, and the owner has no alternative but to pay; but, if he is precluded from any appeal from the certificate, he has a remedy against the architect who gave it, if it is shown to be erroneous. There are several decisions which establish this point, all of them, as far as our references go, being in Illinois Courts.

IN the comments made by the Committee on the three cases, they say that "If the architect should not thus expressly declare himself to be sole arbiter, he would not be excused, but held under the rule of established custom." If this means that established custom regards the architect's certificate as infallible, and not open to question, it is fortunate for the profession that the custom prevails only over a very limited area. Architects have quite enough responsibility placed on their shoulders in seeing that the construction of our complicated modern buildings is correctly designed, and that the materials are judiciously chosen, without assuming to guarantee the perfect execution of work which they could not oversee in detail if they had the eyes of Argus, and devoted their whole time to inspection; and many of the best of them, in order that there may be no question as to the effect of their certificates, write them in the form that "in their opinion," or, "so far as they can judge," the work has been done to a certain point in accordance with the contract; while others, whose immense practice shows that their prudence and frankness does not frighten away clients, declare in print on their letter-heads that they "will assume no responsibility in regard to the execution of the work by contractors." The architects who guard their interest thus carefully are men who have money to lose, and who know by experience how great are the risks to which the members of our profession are exposed, and their example is well worthy of imitation by the younger architects, who will find that careful clients, with money to invest in important buildings, will choose an architect who knows how to manage his own affairs with prudence and discretion, in preference to one who recklessly assumes responsibilities through which he may be ruined in a day, without any fault of his own.

THE daily papers announce a great reduction in the price of aluminium, due to the improvement in the process of making it, and the result is likely to be a very great extension of its use. At present, the price, in lots of one thousand pounds or more, is two dollars a pound; for five hundred pounds the price is two dollars and a quarter a pound, and in smaller quantities the price per pound is somewhat increased. Practically, the price for all sorts of manufacturing purposes will be, for the present, two dollars a pound, as no manufacturer would buy a less quantity than half a ton. At this price it is for many purposes the cheapest material that can be used. The articles now made of German silver, and plated with silver or nickel, such as harness-mountings and many articles of builders' hardware, will be much cheaper, stronger and better of aluminium, which, at the new price, costs less than the German-silver base of the objects now sold. It must not be forgotten, in comparing aluminium with other metals, that it is only one-fourth as heavy as silver, and less than one-third as heavy as copper, the specific gravity being about the same as that of sulphur, so that if, for example, ten pounds of bronze metal, costing four dollars, will make ten pairs of door-knobs, at a cost, for material, of forty cents a pair, the same weight of aluminium, costing twenty dollars, will make thirty-three pairs of knobs, costing, for material, sixty cents a pair, but infinitely preferable to the bronze in nearly every respect. For plumbing fixtures, the solid aluminium would be about as cheap as the ordinary brass plated with nickel, and cheaper than brass plated with silver, but the aluminium has in this case the disadvantage of being acted upon by strong alkalies, so that washing-powders, or even the fancy toilet-soaps, some of which are strongly alkaline, might take off the polish from the faucets with which they came in contact. It would seem quite possible to remedy this defect in the pure metal by alloying it with a metal not attacked by alkalies, and, when this is done, a new and extensive field will be opened for its use.

THE last act in the great copper speculation of 1888 has just closed, with the decree of the court in the case of the directors of the banking-house of the Comptoir d'Escompte, which, it will be remembered, was ruined by its advances of money to carry out the unsuccessful attempt to "corner" the copper-supply of the world. The stockholders in French companies are very tenacious of their rights, and object to being betrayed by those in whom they place confidence, and, on the discovery of the bankruptcy of the company, they instituted proceedings, to see how far the directors could be held responsible for misconduct or neglect of their duties. The judgment in the matter of the Tribunal of Commerce has just been rendered. The manager of the company during the time of the copper speculation, M. Denfert-Rochereau, having committed suicide some months ago, was out of reach of the court, but his successor, M. Edward Hentsch, the President of the Council of Administration, together with four other members of the Council, who were found to have been, at the time of the transaction, either members of the Société des Métaux, or interested in some other way in the speculation, were condemned to pay two million, four hundred thousand dollars into the treasury of the reorganized company, in the usual French way, under which, if any one of the condemned has not the four hundred and eighty thousand dollars forming his portion, he must give up all he possesses, and his associates in the condemnation must make up the rest. Of the other directors, ten, who were not personally interested in the copper speculation, but who did not oppose, after they became aware of them, the operations begun without their knowledge by Denfert-Rochereau, are condemned to make up in the same way a contribution of twelve hundred thousand dollars to the treasury of the new company; and the "censeurs," or examiners, who ought to have seen that the stockholders' money was being improperly used, are required to pay two hundred thousand dollars.

THE Union Syndicale, or Master Builders' Association, of Brussels, advertises four competitions for the best devices for scaffolding of various sorts, eight prizes being offered. In Competition A, the first prize, of one hundred dollars, is to be given for the best scheme for a hanging stage, for the use of painters, and for washing down and pointing walls of masonry, to be shown by drawings, or a model, or both; and a second prize, of forty dollars, is to be given for the second-best plans for the same device. The subject of Competition B, is a staging standing on the ground, to be used for the same purposes as the hanging stage of the previous competition, and two prizes are offered, one of thirty dollars, and the other of ten dollars. The prizes in Competitions C and D are the same as in B. The subject of the first is a general scaffolding for the construction of city dwellings, where the weights to be supported on the staging are not very great; and that of the other is a system for protecting workmen on the roofs of buildings against accidents. Notice of intention to participate in the competitions must be sent to the Union Syndicale, Palais de la Bourse, Brussels, Belgium, before November 10, and further instructions can be obtained by writing to the same address. It is much to be hoped that the results of these competitions may be made public. We, in America, are rather behind the rest of the building world in the matter of scaffolding. Timber is cheap with us, and we think we can afford to nail joists and boards together and destroy them in taking them down, where an English or French builder is obliged to use poles, carefully tied together with chains and ropes, so as to get as much strength as possible, without injuring the materials for subsequent use elsewhere. Already, however, in New York, pole and rope stagings, like the foreign ones, are rapidly superseding those of joists and boards, and the more economical fashion is likely soon to become general. When that time arrives, there will be room for the display of a great deal of American ingenuity in the invention of new methods of tying and bracing, but it will do no harm to learn all we can about the best foreign methods as a preliminary, so that our progress may begin from as advanced a point as possible.

FILTRATION AT THE EXPERIMENTAL STATION IN LAWRENCE.[1]

Belfry at Runkel. From *Architektonische Rundschau.*

THE experiments upon filtration of water and sewage at the Lawrence experimental station have been continued by the Board throughout the year with very satisfactory results, giving additions to the knowledge of the world upon the subject of filtration, and showing, upon a scale large enough to approximate to the conditions of actual practice, the practicability or impracticability of methods heretofore deduced from laboratory experiments.

These results are elaborately presented and discussed in the Supplement by Mr. Mills, a member of the Board, who has had these experiments under his immediate charge.

Some of the general results only will be presented here.

Sewage can be much more efficiently filtered through open sand than through sand covered with soil. Very fine material, like dust, in the upper layers of a filter prevents free access of air, and, when wet, may exclude air so completely as to render purification impossible. With soil or sand containing dust at the surface, periods of intermission in the application of sewage may be made so long that the surface, becoming dry, may allow air to enter, and a high degree of purification may result; but the quantity of sewage that can thus be purified is very much less than when the upper layers of the filter are composed of open sand, through which the sewage will rapidly disappear, and will leave room for air to enter and come in contact with the thin laminæ of liquid covering the particles of sand.

The experiments of last winter show that intermittent filtration can be carried on upon a bed of coarse sand through the coldest weather when the beds are exposed to snow, but that the efficiency of the beds is much reduced by such exposure and the consequently low temperature of the sewage passing through the sand. By protecting the beds so that snow cannot fall upon them and reducing the temperature of the applied sewage to near the freezing point, the experience of the present winter, so far, indicates that very complete purification may be continued through very cold weather by applying the sewage intermittently at the temperature at which it ordinarily comes from the sewer. The experiments of last winter show that, when the beds are exposed to the snow, intermittent filtration may be carried on through the moderate weather of winter, alternated by continuous filtration during the colder period.

Filtering areas of sand covered with soil, or areas of very fine sand, may be much increased in efficiency in both summer and winter by digging trenches in the direction of a slight incline, about two feet deep and one foot wide and six feet apart, and filling them with coarse sand. The sewage should be applied to this coarse sand, and, once in a month or two, a half-inch in depth should be taken from its surface and replaced by clean sand. In winter the trenches should be covered with boards to keep out the snow.

The general results obtained at each of the filters will be briefly stated. To all of them, unless otherwise stated, sewage was applied intermittently at intervals of one or more days, and disappeared from the surface in a few minutes or in a few hours.

Four tanks, filled with clean, coarse mortar-sand from the same pit, were subjected to different conditions. One of these was exposed to the cold and snow, and, although it received sewage daily and removed about two-thirds of the impurities of the sewage during the very cold months of January, February and March, when filtering at the rate of 30,000 gallons per acre per day, it is evident from the results in the other three tanks, which were not exposed to frost, that the sewage entered and passed through but a fractional part of the area of this tank; and the result is as poor as if a much larger quantity had been applied to a like area not obstructed by frost.

The three other tanks were supplied with sewage at the rate, respectively, of 30,000, 60,000 and 120,000 gallons per acre per day; and, until nitrification commenced, in the latter part of March — periods of forty-one, thirty-one and twenty-seven days, respectively — the ammonias indicated that 97, 94 and 80 per cent of the impurities of the sewage were removed.

Nitrification began to increase in all of these tanks between March 26 and 30, when the temperature of the effluent was at 39° or 40°. In the course of three weeks the nitrates had increased from 0.025 parts in 100,000 to 0.250 parts, after which they increased much more rapidly, and nitrification was most complete from May 6 to 10, or six weeks after it began — the nitrates then amounting from 2.5 to 3.0 parts per 100,000.

During the increase in nitrification the ammonias also increased for a time, and became nearly one-third of those of the sewage; but, generally, before the nitrification reached its height, the ammonias decreased rapidly, until they became between one-half of 1 per cent and 1½ per cent of those of the sewage.

The rapidity of purification, as shown by the decrease in ammonias, was greatest in the tanks which had received the most sewage and had the greatest amount of nitrogenous matter stored in them, the effluent from the sand which had received the least sewage being more than a month later in reaching its condition of greatest purification.

The filter receiving sewage at the rate of 120,000 gallons per acre per day gave an effluent for three months after purification resulting from nitrification was established, in which the ammonias were less than 1½ per cent of those in the sewage. Upon increasing the amount filtered to 180,000 gallons per acre per day the ammonias increased, but for the next four months averaged less than 2 per cent of those of the sewage.

One of the filters, receiving sewage at the rate of 60,000 gallons per acre per day for seven months after purification was established, gave an effluent of nearly constant quality, having one-half of 1 per cent of the ammonias of the sewage, the free ammonia averaging 0.0012 parts and the albuminoid ammonia 0.0105 parts in 100,000 parts, showing less organic matter than many of the drinking-waters of the State.

The other filter of the same material, receiving 60,000 gallons of sewage per acre by day, gave an effluent for three months after purification was established, having between 1 and 2 per cent of the ammonias of the sewage, but in the next two months these increased to 6 and then to 10 per cent. This increase was due in part to the imperfect distribution of the sewage over the whole surface, which being corrected, the percentage of the ammonias decreased, and averaged for December 4½ per cent of those of the sewage.

The tank of this material, which has filtered at the rate of 30,000 gallons per acre per day, was, as stated, a month later than the others in reaching an established condition after nitrification became active. For the following six weeks the ammonias of the effluent were but 1 per cent of those of the sewage, and the nitrates were a little more than one part per 100,000.

At the end of this time the outlet was closed and the tank filled with sewage, and for the next four months the surface of the sand was kept covered with sewage, and the outlet was opened each day sufficiently to allow the regular quantity at the rate of 30,000 gallons per acre per day to flow out. The filter was thus changed from the condition of intermittent filtration to that of continuous filtration. During the first month the nitrates were reduced from one part per 100,000 to less than 0.01 part, at which they continued for the remaining three months. The ammonias rose in the first month from 1 per cent to 1½ per cent of those of the sewage. In the second month they become 31 per cent, and at the end of the fourth month were equal to those of the sewage.

This shows distinctly the radical difference in result between intermittent and continuous filtration. In intermittent filtration the nitrification was active, and, as shown by the ammonias, 99 per cent of the organic impurities were removed; while in continous filtration the nitrification ceased, and the same sand, filtering the same quantity of sewage, stored impurities for a time, but finally poured out an effluent quite as impure as the applied sewage.

From these open sands the number of bacteria in the effluent has, during the past six months, varied from 2 per cent to a very small fraction of 1 per cent of the number of bacteria in the sewage.

A filter of very fine sand, after filtering an amount equivalent to 8,600,000 gallons of sewage upon an acre, filtered at the rate of 12,000 gallons per acre per day, giving an effluent in which the organic matter, shown by the loss on ignition, was but 3 per cent of that of the sewage; and the nitrogenous matter, as shown by the ammonias, was but one-quarter of 1 per cent of that of the sewage.

The loss on ignition was	0.5000	parts in	100,000.
The free ammonia	0.0002	"	"
The albuminoid ammonia	0.0062	"	"
The nitrates	0.7000	"	"

At the same time, the bacteria of the sewage amounted to 591,000 in a cubic millimetre, while those of the same quantity of effluent amounted to 2, and these may have come from the air while collecting the sample.

By both chemical and bacteriological analysis, this effluent from sewage has less organic impurity than the water of Lake Winnipiseogee, and contains but little more nitrogenous organic matter than city water filtered through the same material a year ago.

This sand stored much impurity in the winter. Nitrification began actively in June, and for three months appeared to be active in removing stored impurity, so that purification did not approach the completeness given above till September, since which time it has steadily grown more complete.

Another sand still finer than the last, having more than 10 per cent of very fine dust, and also containing nearly 2 per cent of organic matter (making up what is known as river-silt), gives its best results in December, after filtering in one year 45,000 gallons of sewage — the equivalent of 9,000,000 gallons on an acre — and while filtering at the rate of 12,000 gallons per acre per day. The organic matter of the effluent in the first half of December was reduced to one-quarter of what it was previously, and became but 4 per cent of that of the sewage; and the nitrogenous matter, as expressed by the ammonias, became 3½ per cent of that of the sewage.

[1] From the Twentieth Annual Report of the State Board of Health of Massachusetts.

The loss on ignition was	1.0	parts in 100,000.
The free ammonia	0.0800	" "
The albuminoid ammonia	0.0190	" "
The nitrates	0.1500	" "

The number of bacteria in a cubic centimetre of the sewage was 1,100,000, and the number in the effluent 7.

The ammonias of the effluent averaged, from March to August, 27 per cent of those of the sewage, and from September to November, 11 per cent of those of the sewage.

This material has given poor results during ten months of the year, but has greatly improved during the past month, when sewage has been applied once in two or three days, and rain has been excluded from the surface.

Garden-soil makes a very poor filter. Upon applying sewage intermittently to a body of garden-soil five feet deep, after the first month the organic impurities increased continually for eight months, until the effluent became more impure than the applied sewage. There had then been applied 24,000 gallons, the equivalent of 4,800,000 gallons on an acre, and it was then being applied at the rate of 10,000 gallons per acre per day. The daily quantity passing through has since been reduced to 5,000 gallons per acre per day, and the quality of the effluent has somewhat improved, but still contains as much nitrogenous matter as crude sewage.

The best results are the last, and are as follows:

Loss on ignition	12 2	parts in 100,000.
Free ammonia	2.9200	" "
Albuminoid ammonia	0.2900	" "
Nitrates	0.0250	" "

The bacteria number 109, while in the sewage they numbered 200,000.

The effluent just described has been about two months in coming down through a depth of five feet of soil. In this time sewage has been applied once in two or three days, and of late the 50 gallons applied disappears in two or three hours. This garden-soil contains but little coarse material, and probably 50 per cent of it would be called fine dust.

A mixture of coarse and fine sand and fine gravel four feet deep has filtered sewage for eleven months very satisfactorily. During the cold months of February and March, the ammonias of the effluent were 25 per cent of those of the sewage. They decreased in May to 5 per cent, and for the past six months have been continually less than 1 per cent, and now are one-quarter of 1 per cent of those of the sewage. In July, after 30,000 gallons of sewage had been applied — equivalent to 6,000,000 gallons upon an acre — and while applying 57,000 gallons per acre per day, the effluent had three-quarters of 1 per cent as much free and albuminoid ammonia as the sewage; but this was too large a quantity of sewage to be applied daily for a long period. In August, the same result was obtained when applying at the rate of 42,000 gallons per acre per day. One-quarter of 1 per cent was maintained through September and October when applying 35,000 gallons per acre daily, and the same percentage continues through November and into December while applying 25,000 gallons per acre daily. The final analysis gives the following result:

Loss on ignition	0.8000	parts in 100,000.
Free ammonia	0.0000	" "
Albuminoid ammonia	0.0042	" "
Nitrates	0.7800	" "

The bacteria of the effluent numbered 14, while those of the sewage numbered 350,000.

The organic impurities of this effluent from sewage are much less than those of most of the water-supplies of the State.

Another tank, having four feet in depth of material like the last, filtered sewage with nearly the same results until the first of September, when it was covered to the depth of one foot with peat from Saugus marsh, well pulverized. Upon saturating this with sewage, the quantity flowing through became only 2,800 gallons per acre per day; and, with the top of peat continually covered with sewage, the quantity flowing through has decreased in three months and a half to 1,400 gallons per acre per day, and the ammonias are nearly equal to those of the applied sewage.

Another tank has the lower four feet of like material covered with ten inches in depth of yellow, sandy loam and six inches of brown soil. Comparing the results with the filter having four feet of like material without the loam and soil, we find this filter with loam and soil, with the same amount of sewage applied, stored up impurities for a longer time, but after they reached the bottom the effluent continued during the cold months very like that of the former; but this quality of the effluent continued much longer, and when nitrification began, a month later than in the former, the amount of nitrification and the consequent purification were much less. The same quantities of sewage were applied daily to each until the middle of June, when this effluent contained ten times as much ammonia as the other, and the surface of this became so choked that the quantity was reduced to about 4,000 gallons per acre. Nitrification nearly ceased, and, with this small quantity, the effluent was but little better than in the cold months, when seven times as much sewage was filtered. In July, no sewage was applied for twelve days, after which one-half inch in depth of the soil was removed from the surface, and the quantity was increased to 20,000 gallons per acre per day. The impurities doubled; but nitrification again commenced, and they were reduced, and upon reducing the quantity applied to 15,000 gallons per acre per day — making the application of double this quantity once in two days — the impurities decreased rapidly, and in the beginning of October the effluent reached the condition which that of the other filter without the loam and soil attained the first of June, when twice as much sewage was filtering. During the latter part of October and through November and to the middle of December, when filtering from 10,000 to 12,000 gallons per acre per day, by applications once in two or three days, the effluent has been very nearly as pure as that from the sand and gravel without the loam and soil, where about three times as much sewage was filtered. The final analysis of effluent, which is the best, is as follows:

Loss on ignition	1.0000	parts in 100,000.
Free ammonia	0.0008	" "
Albuminoid ammonia	0.0052	" "
Nitrates	0.8000	" "

The bacteria have, during the past month, varied from none to twelve, and it may be that none came through the filter, but that the few counted came from the air while collecting the sample.

Four tanks of material from Saugus marshes, placed so as to present the conditions for a depth of five feet as nearly identical as possible with those at four places on the marshes where the depth of peat was one and a half feet, two and a half feet, three and a half feet and five feet, have received sewage daily for six and seven months. The amount of sewage that will pass through the peat is so small that they are all worthless as filters. That in which the peat is five feet deep has had sewage upon the surface for more than six months, but none has reached the outlet. That in which the peat is three and a half feet deep has had some liquid from the sewage flowing out for more than a month, and the impurities of the effluent increased five-fold. In the two tanks having a less depth of peat the sewage reached the bottom earlier, and the effluent is rapidly becoming as impure as the sewage.

Experiments upon the filtration of city water have been continued in two tanks. One of these contained coarse and fine sand and fine gravel to a depth of four feet, overlaid with fine, sandy loam one foot deep, and a surface-layer eight inches deep, of the same quality as the lower section.

During the cold months of January, February and March this material filtered city water at the rate of 50,000 gallons per acre per day, and removed three-quarters of the nitrogenous organic matter, as shown by the ammonias. The nitrates were a little less than in the water applied.

From the 5th of April, when the temperature of the effluent was 39°, and the nitrates were 0.012 parts in 100,000 — the same as in the applied water — they increased continually until June 5, when they became 0.080 parts, after which they decreased for a month to 0.025 parts, near which they have remained for six months, in which time they have been nearly the same as the nitrates of the applied water. During the month when they were highest, from the middle of May to the middle of June, nearly two and a half times as much nitrogen came out of the filter in the effluent (mostly in the form of nitrates) as was applied in the city water. Some of the nitrogenous matter which had been stored in the sand during the winter was thus removed.

For the three months of April, May and June, the average quantity filtered was at the rate of 35,000 gallons per acre per day, and the ammonias were 42 per cent of those of the applied water. The quantity was then increased, and continued until the middle of November at the rate of 200,000 gallons per acre, applied daily on six days in a week, with the resulting ammonias one-quarter of those of the applied water.

From the middle of November the quantity has been still further increased to 300,000 gallons per acre, applied daily for six days in a week, with the resulting ammonias one-third of those of the applied water. The average of the analyses for this period is as follows:

Loss on ignition	0.6200	parts in 100,000.
Free ammonia	0.0002	" "
Albuminoid ammonia	0.0034	" "
Nitrates	0.0260	" "

During the summer and fall, all of the vegetable organisms of the city water which can be identified by the microscope were removed by this filter. Of the bacteria, about one-quarter as many as in the city water have been found in the effluent when the largest quantity was being filtered.

To the other tank of sand five-and-one-half-feet deep water has been applied in much larger quantities. Water covering the sand in the tank to the depth of six inches passed through at the rate of three hundred million gallons per acre per day, and it is so open that, after draining a short time, air can readily be blown through the whole depth of it. It is from the same pit as the sand of the first four tanks mentioned above.

For three months water was applied hourly fourteen times a day, making a total quantity which is at the rate of four and a half million gallons per acre per day. The amount applied disappeared from the surface in about six minutes.

For two and a half months during July, August and September the filtered water improved. The organic matter shown by the loss on ignition and by the ammonias was about two-thirds of that of the applied water, and the color was entirely removed.

The bacteria were reduced to about one-eighth of those of the applied water, and the organisms that can be identified by the microscope were at times very much reduced; but at about the end of the time mentioned some species increased day after day, and soon far exceeded the number in the applied water. Two weeks later, the color of the effluent became as deep as that of the applied water, and the ammonias were nine-tenths of those of the applied water. This condition continued for a month and a half, when the quantity applied was reduced to about two million gallons per acre per day, at which rate it has since been continued. The resulting color has been about three-quarters as deep as that of the applied water; the ammonias continue at nine-tenths of those of the applied water, and the bacteria remain about the same as before, but the microscopic organisms are very much reduced.

From the results with these two tanks, we conclude that the vegetable organisms which render many waters objectionable may be filtered out by intermittent filtration at the rate of 300,000 gallons per acre per day, and probably at a much higher rate; but we have not yet succeeded in removing enough of them to give a satisfactory result when filtering at the rate of 2,000,000 gallons per acre per day.

Experiments upon rapid continuous filtration of drinking waters have been made by the Board, the results of which are stated in the report to the city of Brockton, contained in the first section of this report.

Returning to the slow filtration of the tanks receiving sewage, a very few vegetable organisms that can be identified by the microscope have been found to occasionally pass through the coarser filters, but in general none come through. A few animal forms have been found in the effluent, but these may grow in the underdrains and outlet pipe. The question remains to be settled, whether any animal or vegetable microscopic organisms live to get through the filters of finer material at the rate which sewage has been filtering. Of the still more minute organisms, the bacteria, we found that soon after sewage was first applied to the tanks they came through in great numbers, but became reduced in number, and during the later winter and spring months amounted to two per cent and less of those of the applied sewage; but after nitrification commenced they decreased rapidly, and continued through the summer, in many cases, less than one hundred, and in some less than ten, while the number in the same quantity of applied sewage was about a million. This result led to the question whether any of those contained in the applied sewage during the summer came through the filters, and this question was referred for solution to Prof. Wm. T. Sedgwick, whose report will be published in the Supplement.

The experiments made under his direction to the present time show that the number of bacteria in the sand decrease very rapidly from the surface downward. In the finer sands, they nearly or quite disappear before the bottom is reached. Experiments are in progress to prove whether any live to come through the finer sands with the effluent, but they have already shown that through the very coarse sands they are brought with the effluent in very small numbers, with the ordinary rate of flow from the sewage-tanks, and that when the rapidity of flow is the highest the number of bacteria in the effluent has reached as high as two per cent of the number in the applied sewage.

In some of the tanks it appears that, of the large number of species found in the sewage, a single species only lives to reach the outlet.

We have reason to hope that filters may be so made and managed that all disease germs may be with certainty removed, and think this important subject should be pursued to definite conclusions.

RECOMMENDATIONS.

Owing to excessive rainfall during the past two years, there are many drinking waters in the State polluted by sewage, which, being so much diluted, appear in our records as of much better quality than they will be during a dry season. The Board recommends that examinations of these sources be continued, as well as of others which show peculiarities at different seasons of the year; also, that experiments be continued upon intermittent filtration of surface-waters, to determine the conditions in which color and objectionable vegetable growths may be removed.

The Board also recommends continuance of the experiments upon the purification of sewage at Lawrence, together with experiments upon clarification of sewage by chemical precipitation.

For these purposes, and to make the necessary investigations in order to advise cities, towns, corporations and individuals in regard to the best method of assuring the purity of intended or existing water-supplies, and the best method of disposing of their sewage, and to carry out the other provisions of Chapter 375 of the Acts of 1888, the Board estimates that the sum of twenty-five thousand dollars will be required.

HENRY P. WALCOTT,
ELIJAH U. JONES,
JULIUS H. APPLETON,
THORNTON K. LOTHROP,
FRANK W. DRAPER,
HIRAM F. MILLS,
THEODORE C. BATES,
State Board of Health.

THE SULPHUR MINES OF SICILY.[1]

Belfry at Lorsch.—*Architektonische Rundschau.*

THE mine district in Sicily comprises the provinces of Cantania, Caltanissetta, Girgenti, and the commune of Lercara, in the province of Palermo. There are in all five hundred and sixty-seven mines, one hundred and ninety-one of which are closed, on account of being remote from the railway lines, and carrying the mineral on the back of mules or donkeys does not pay to work them.

The interior of a mine is carried with pillars and vaults in the same manner as a coal mine. There you see the same galleries, the same portable underground rails, the same small wagons by means of which the rock (brimstone ore) is carried to the vertical or inclined shaft, and through this by means of steam-engines is lifted up and piled on the open soil.

The galleries in the mines are sustained by pillars of rock superposed one upon the other, and there are galleries one under the other until the stratum is exhausted. When the mine has surpassed the depth of forty metres water is generally found, and the hauling engine is used also for pumping. The air of the interior of a mine is generally impregnated with gases, often inflammable, and the first care in opening a new mine is to get a current of air. This is obtained by opening a second pit-hole communicating with the first. Safety lamps have been introduced everywhere in order to prevent explosions.

By a recent law every mine is to be supervised by a mineralogical master (*capominatore*) in order to prevent disasters, and to hold the fitters, owners or contractors responsible for same, or for accidents happening to workmen when laboring. On the other side owners or fitters, by means of a small premium paid to the "Cassa Nazionale sugli Infortuni" (National Insurance Bank) against accidents happening to laborers, are able to stand such losses.

In those mines where there are no engines the material is carried in bags by boys on stairs on the inclined shaft up to the open soil. When the engines are in use it is hoisted up in wagons.

The melting of brimstone is only allowed by the Italian Government from the 24th of June till the end of October, as the evaporating acids injure the grain fields.

The smelting process is very simple and takes place at the mines. No machinery, no engineers are to be seen; the ore is simply put in kilns (*calcaroni*) of the capacity of from 100 to 1,000 cubic metres, filled with lumps of ore and covered with earth, in order to prevent excessive evaporation. The mass is then lighted on the highest point of the inclined line of the bottom of the kiln. When fire has made a good progress in the kiln it is covered completely, and slow internal combustion commences, a good quantity of the mineral acting as fuel for heating and smelting the whole mass. In about five days a hole is made at the lowest point of the inclined bottom of the kiln, and the sulphur flows out in a liquid state into small wooden forms of the capacity of about sixty-five kilograms, which are filled continuously one after the other until the kiln has ceased to flow. The liquid brimstone is then kept for about three hours in the forms, just sufficient time for cooling and changing into a solid state. In cooling the sulphur contracts, and falls easily out of the forms. It is then ready to be sent to the nearest harbor for shipping. It is graded into seven different qualities, from the finest yellow to the darkest brown, and denominated: Licata, first quality; best, second unmixed; good, second unmixed; current, second unmixed; best, third unmixed; good, third unmixed; current, third unmixed. When the ore is very rich steam is used instead of fuel, and different systems covered by patents are adopted. The work is paid by cubic measure of mineral (ore) brought out of the mine. The work in the mine is considered unwholesome; as proof thereof it is to be remarked that in those provinces of Sicily where mines are abundant the greatest number of young men are deformed and unfit for military service.

The number of workmen employed in a mine is, according to the importance of the same, from four to four hundred men and boys, working on an average eight hours, and earning about three lire for men and one and one-half lira for boys (1 lira = 19.3 cents). The miner with his small earning to support his family has to live very economically. Miners pay no personal taxes except the commune tax, which is included in the price of victuals. Every mine has a gang of boys to carry the ore out of the mine where the work is not done by machinery.

The refinement of brimstone is made with different systems (patented), but on the same principle. Brimstone is put in retorts and through a small fire is evaporated and condensed in cooling ovens. The grinding is done in different ways, all kept secret. Rolling, crushing or vertical stone-mills are used; but I should never advise American buyers to import ground brimstone, as very often it is adulterated with sundry stuffs, such as chalk, earth, strontia,

[1] Extracts from the report United States Consul Vincent Lamantia to the State Department.

etc., and dyed with chromate of yellow. Many sulphur mines have been worked in Sicily by foreigners, but very few of these have succeeded in getting any profit.

The Illustrations

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE UNION THEOLOGICAL SEMINARY, PARK AVE., 69th AND 70th STREETS, NEW YORK, N. Y. MESSRS. LORD & POTTER, ARCHITECTS, NEW YORK, N. Y.

[Gelatine Print, issued only with the Imperial Edition.]

HOUSE OF WM. HAMLIN, ESQ., BUFFALO, N. Y. MESSRS. MARLING & BURDETT, ARCHITECTS, BUFFALO, N. Y.

THE house is built of Kibbe sandstone up to the first-story window-sills, the walls above being of mottled Pompeian brick, specially made for this work at Perth Amboy, N. J. The window jambs, arches and cornices are of moulded brick of special design. The roof is covered with red Spanish tile laid in cement, with copper flashings. With the exception of the roof, the house is of fireproof construction throughout, all interior walls, partitions and furrings, without exception, being of hollow-brick or terra-cotta. The house is heated throughout by indirect hot-water radiation, the temperature of the various rooms being regulated by the "Johnson Heat Regulator." The plumbing work is of the most elaborate description, the bath-rooms, lavatories, etc., being tiled, with all piping exposed and nickel-plated throughout. Special ventilation is secured by a large vent-shaft, heated by the furnace smoke-pipe, with ventilating-ducts connecting with the various rooms and closets. The plans show the arrangement of the first and second floors. The basement contains the laundry, preservatory, furnace and coal rooms, and store-rooms. The third story contains two guest-rooms, five servants'-rooms, two dressing-rooms, two bath-rooms, play-room, 19′ x 28′, linen and trunk rooms. The house is handsomely finished throughout in hard woods, the main hall being in prima vera, a special feature being an arcade between the hall and library of rose Aurora marble and onyx. The principal rooms have hard-wood floors with inlaid borders, the vestibule floor being of marble mosaic. There are seventeen fireplaces in the house, many of them having facings and hearth of rich African marbles or marble mosaics. The kitchen has the walls built of English glazed brick. The house is arranged to be lighted throughout by electricity, but is also piped for gas, with electric gas-lighting. In fact, no pains have been spared to make the house complete in every respect.

HOUSE AND LAUNDRY FOR FRANCIS W. KENNEDY, ESQ., BRADFORD HILLS, CHESTER CO., PA. MR. FRANK MILES DAY, ARCHITECT, PHILADELPHIA, PA.

THE house is situated near the main line of the Pennsylvania Railroad, twenty-nine miles from Philadelphia, on a hill commanding extensive views of both the Chester and Brandywine Valleys. The cedar shingle roofs remain unpainted.

A METHOD OF EMPLOYING HOLLOW BLOCKS IN BUILDING. MR. W. REDMORE RAY, ARCHITECT, LOS ANGELES, CAL.

LOS ANGELES, CAL., September 26, 1889.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Among the drawings I have forwarded for reproduction, if you please, is one I trust you will not consider merely an advertising scheme on my part, but that the idea contained therein is of sufficient interest to the architectural profession to warrant its appearance, though it is due to you to state "Letters patent" were granted me for the same, the 12th of March, the current year.

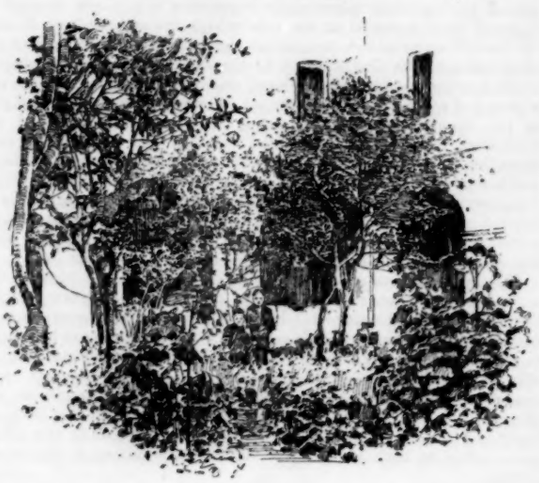
As will be seen, the method consists in constructing walls of hollow blocks or frames of any convenient size or shape (not necessarily rectangular) each block having a groove around its outer periphery — the nature and purpose of the groove, when the blocks are placed in position, is to receive liquid cement or molten lead, forming when hardened a continuous dovetail, key or dowel throughout, binding the blocks as one. The slabs or plates forming the inner and outer wall-surfaces are then fitted: they conform in outline to the blocks, have rebated edges and a surrounding groove. Cement and strap-iron at intervals give the required adhesiveness to the blocks. The continuous cross-joints of this method admit of its easy combination with steel in the construction of walls for many storied structures, as even for floors and roofs. Walls so constructed of suitable materials would be light and durable, fire, vermin and weather proof; greater ease, accuracy and expedition in use, no waste of material; lathing and plastering entirely dispensed with and an opportunity for new improved wall-surfaces, having advantages over those in present use, in regard to durability, impermeability and artistic treatment in form and color.

Whatever may be thought of this as a means, it appears to me the method aims at an architectural "consummation devoutly to be wished," *viz.*: permanent wall-decoration and one, judging from editorials that have appeared in your journal from time to time, notably that of June 9, 1888, you are entirely in accord with and interested in bringing about.

The other drawing shows a further application of this method. The blocks in this instance are twelve inches square by six inches wide: for circular portion of walling no change in form or size of block is necessary, the V-shaped spaces between them being filled with cement and the sweep formed on the slab or plate. As indicated, the roof is constructed of similar blocks and slabs of slightly different form and dimensions to provide a horizontal bed and lap-joints to the slab. The wall-surfaces being impermeable are easily cleansed, contributing to the comfort of the household. The building being hermetically closed, for ventilation a system of fresh-air and exhaust ducts ensures a continuous current of warmed or cooled air as occasion requires throughout the various apartments. The slabs or plates forming the external and internal wall-surfaces are supposed to be of faience or similar ware, but those for the outer walls to be of opaline glass and for purposes of vision omitting a sufficient number of blocks where clear glass is inserted, the entire external wall would be luminous and unbroken, a departure from the monotonous division of solid and void enforced by utilitarian considerations, this division of windows and tiers rendering those thoroughfares other than first-class ones meagre in the extreme. Should we not thus again see the power and grandeur of effect in masses of unpierced walling as in old feudal buildings but far excelling them in interest?

COLUMBUS:

A PILGRIMAGE TO PALOS.



TWELVE years ago, sailing between Dominica and Martinique, the verdure-clad islands midway the Caribbee chain, I first saw land discovered by Columbus. I was strangely thrilled; nor shall any scoffer put me down as a sentimental voyager because I attached an importance to those islands not set down in the admiralty charts.

A year later, and I had added, of the isles the great navigator first described, Guadaloupe, and sister islands, and that fair domain of the Caribs lying not far from the mouth of the Orinoco, Trinidad — *La Trinidad*, the Trinity, so-named by Columbus from its triple-peaked mountain, as he first looked upon it from the deck of his storm-tossed *caravel*, in 1496.

In 1880, during a second visit to the West Indies, I visited all the islands from Porto Rico to Trinidad: the Virgins, by Columbus so-called in honor of the hapless Saint Ursula and her immortal ten thousand; St. Christopher, whose volcano presented the shape of the good giant who bore on his shoulders the infant Jesus, and a score of others of lesser note.

In 1881, on the coast of Yucatan, I was minded of the last voyage of Columbus, in 1502, when he found here that great *canoa* laden with chocolate beans, copper utensils and cottons, and guided by mariners of greater intelligence than any other of these new peoples he had seen.

Seven years later, in 1887, I had the Bahamas to explore, and then first saw that island on which Columbus first landed, San Salvador, rising ghost-like from the sea. Beyond, the cloud-like expanse of Watling's Island, the first land-fall of that eventful voyage of 1492. The south coast of Cuba gave me *Las Jardines de la Reina* those emerald "Gardens of the Queen," and *Cienfuegos*, the "Bay of the Hundred Fires."

Wherever I had voyaged, I had met with reminders of Columbus. And, having viewed with so keen an interest these fruits of his garnering, was it strange that Spain, the mother-country, should have held for me no more precious relics than those of Columbus?

Throughout Spain, to-day, are scattered these memorials of Colon. In Madrid, the Royal Armory contains his armor, the naval museum one of his charts. At Valladolid he expired, in 1506, and the house is still pointed out in which he drew his last breath. It is now put to ignoble uses, and a sign upon it proclaims it the depository of cows' and asses' milk: "*leche de vacas y de burras, se sirve á domicilio.* The convent, also, is there, in which his remains were first interred.

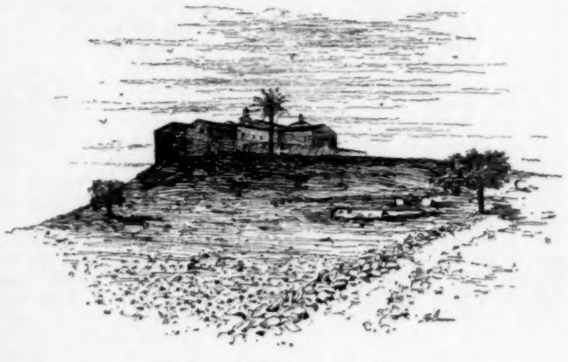
The student may trace the wanderings of Columbus through all Spain, but it is in the South, in Andalusia, *la Tierra de Maria Santissima*, that most of his memorials are found. Notably is Seville, queen city of the Guadalquivir, rich in *Colombiana*, chiefly found in the Columbian Library, containing the 20,000 volumes given to the cathedral by Fernando Columbus. There, in charge of jealous guardians, are many valuable books, and (if one may believe what we may scarcely doubt) the very journal of Columbus, a volume with marginal notes by his own hand, and one of his charts. Those very islands of the Bahamas, which I myself have seen, dim and shadowy, and shining in the sun, are here outlined by the great discoverer himself, upon paper discolored and stained by sea-salt, as though it had accompanied him on all his voyages.

But, the greatest wealth of Columbian and post-Columbian material for history is buried in the archives of the Lonja, that magnificent building erected by Charles III, about a hundred years ago. Here, carefully bundled, and secured in mahogany cases, are the famous archives of Seville from the first period of American history — *Los archivos de las Indias.* Access to their vast wealth the early historiographers of Spain often had, but it has not been half exploited. Hither, also, came Washington Irving, sixty years ago; but I doubt if he quarried much.

Framed separately and hung against the wall, are the signatures of the most famous of those *conquistadores* who made Spain's power so great: such as Balboa, Cortez, Vespucci, De Soto, Velasquez, and the sign-mark of Francisco Pizarro. Every one is well-nigh priceless, every one that of a man more famous than whoever may read these lines; yet, we may not linger to examine them now.

That which oftenest drew me, and longest held me, was the marble slab in the pavement of the great cathedral that formerly covered the remains of Columbus, and now marks the last resting-place of his son, Don Fernando. All the world has heard of this marble, let into the pavement of the cathedral, at the west end of the central aisle, with its oft-quoted inscription: "*A' Castilla y Leon, Mundo Nuevo dió Colon.*"

The inscription is in quaint old Castilian, in a circle, with a finely-carved *galera* — such as Columbus sailed in — on either side. In the centre is a globe in outline, with arms and banners around it. But the remains of Columbus do not rest here, though brought to Seville from Valladolid: they were taken hence to San Domingo, in the early part of the sixteenth century; when that island was delivered to the French, about a hundred years ago, the ashes were



Convent of La Rabida, Palos.

taken to Havana, where a tablet in the cathedral there indicates the supposed last resting-place of Colon. It is denied by the Dominicans that it was the remains of Columbus that were taken, but some other, perhaps his brother Bartholemew. Let them decide between themselves; it matters little, for not much remains to quarrel over, after the lapse of nigh four hundred years.

The greater, the more glorious, remains of Columbus, are to be seen in Spain, and mainly in Seville. At Seville, I dwelt in a priest's house, and my friend gave me a letter of introduction to the *cura* of Moguer, the town nearest Palos. In the morning (28th April, 1888) I left the house at six, accompanied by the faithful servant, Manuel, who carried my little luggage. At the station, the guard would only let him through by the payment of a *real*, and this he paid, for the privilege of seeing me aboard the cars. A *copeta* of *aguardiente* soothed his feelings a little, but I allowed him to vigorously express his opinion of the railway officials before remonstrating. Soon after pulling out of the station, the train crosses the Guadalquivir and flanks the hills, passing through fields of grain and olive orchards. Seville is truly queenly, sitting on the plain, her towering Giralda rising above the outline of distant hills. Two-thirds the distance is through a fertile and highly-cultivated plain, but after that the plains are barren, though now covered with flowers, purple, in many places, with sheets and beds of bloom. We pass the ruined walls of what appears to have been a Roman fortification of ancient times, and then cross a river flowing over ferruginous rocks, most curiously worn. The character of the soil is shown in the color of the water, which is yellow and deep red. It is not till I cross the river a second time, in the *diligencia*, that I remember this must be the historic river, well and truly termed the Rio Tinto!

Just sixty years ago, the gentle Irving crossed these plains, on horseback, and his story beguiles the hours of travel on the train.

I leave the railway at the station of San Juan del Puerto, on the flat lands of the river, and take an old carriage for Moguer, a league

Entrance to Convent of La Rabida, Palos.

distant, on a hill. It was a disagreeable ride, crowded in with men and women, most of them asleep. My companions, such as were awake, were incessantly smoking, and three of them, a man and two women, frequently drinking *aguardiente* from a curious horn with a mouth-piece in its convex side. Contrary to my expectations, I find a good house of entertainment, a *fonda*, at Moguer, with clean beds and an excellent table. Very soon I am served with *almuerzo*, or breakfast, with delicious wine from surrounding vineyards. This wine is of a golden color, with fine bouquet, and is celebrated at Seville as "*el vino de Palos.*" This rich, ochreous earth seems to have bestowed its fatness upon the wine-vat; not the plains of Xeres, produce wine of so rare a flavor as this made on the banks of the Rio Tinto.

Mine host, though a man of intelligence and inquisitive, was lamentably ignorant regarding things Columbian. He excused himself, saying he was from another province, and not posted on the affairs of Palos. "This man, Columbus, when did he sail, and is *el señor* sure that he sailed from Palos? No ship of any size has left Palos these many years; the village, even, is half a mile from the river." But he had lived long enough here to know where the prettiest girls were domiciled, and he insisted on taking me around to look at the house of a vivacious *viuda*, a widow, of whom he was enamored.

We did not see the fair widow herself. "But no matter, *señor estrangero*, you have seen the casket that contains the priceless pearl of Moguer. Ah! had I not a wife and children, my hand, as well as my heart, should be quickly offered her."

"What say you, *amigo mio?* Let me present you to my *querida*. She hath a vineyard, the like of which is not this side the Guadalquivir; and as to herself, you have my word for it, she is a pearl of price. I think she would take to thee kindly; it is the way of women to look with favor upon a stranger, providing he be not ill-conditioned."

I thanked my friend, but insisted that my heart was given over to Columbus — that he had, at least, the prior claim.

"Very well, *amigo*, but you may regret it. Colon must be a dry subject — *muy seco;* but the *viuda* — *ojos brillantes como las estrellas* — eyes bright as stars! My heart, but what a stick is this American! *Vaya!* I'll find thee a boy to act as a guide to Palos; also a *burro*. It makes me impatient to have such a man about me."

Palos and Moguer are a strong league apart, and I must either walk or hire a donkey, no horse being available, and only an occasional *carro* or clumsy cart. The boy my host secured was the surliest specimen in Spain; but this may have been owing to the fact that he had lost one arm early in life, and probably was put to great shifts to get a living. He led up a *burro*, hooked my valise onto his arm-stump, seized the rope attached to the donkey's nose, and then strode ahead without a backward glance. A well-directed oath from Don Pedro took him between the shoulders, as it were, and halted him long enough to allow me to scramble upon the donkey's back; then ahead he went again, pursued by the maledictions of my friend.

"What a devil of a boy, to be sure! And to think that I should have been the means of putting a distinguished traveller in his

charge—one who has come all the way from America to see our little port of Palos. *Bien, vaya con Dios, señor.* God be with you. You have a stick; give the *burro* the force of your arm!"

There was no saddle, and I sat astride an enormous pack of old bags, using my cudgel as a balancing-pole, though frequently bringing it down upon the donkey's drum-like paunch.

The Boy (with a big B) was abstracted, and the *burro* absorbed in meditation. Whenever I spoke to the Boy he turned upon me savagely, so I confined my attentions to the *burro*, tickling his ribs with my club, with occasional success in causing him to wag his ears and amble gently on.

The road is broad and smooth, but traversed by carts only in the vintage season, when the wines are carried to the port of Palos. Vineyards on either hand stretch away to low ranges of hills inland, and to the banks of the Rio Tinto. After an hour or so I sight the hamlet of Palos, a few mean houses scattered over a hillside and a long, straggling street. They are at least half a mile distant from the river, apparently, and it seems a misnomer to call this inland village a "port." But it was a port at the time of Columbus, and is so-called now. Its inhabitants are chiefly engaged in the vineyards of Moguer; some few go a-fishing. Four hundred, as a guess at the number of inhabitants, seems to me enough to include them all.

I drew up my donkey on the brow of the hill, and looked long at the white-walled Palos, so silent before me, so lifeless, so sad. I need not put on paper the thoughts that possessed me as I gazed, nor the pictures that arose before my mental vision; for I am an American, and have a share in that common heritage left us by Columbus.

Four hundred years only have passed since the great Genoese came here, to this very town of Palos, and sailed away, with its handful of sailor-citizens, to the discovery of a continent. And, though since then the cynosure of all eyes, little Palos has slumbered on, unmindful of its fame. One by one its prosperous men were

View from the Convent of La Rabida, Palos.

gathered out of sight; one by one its houses sunk to ruins; one by one its fleet depleted of its vessels, until, to-day, naught remains to Palos save the memory of its greatness. Its present inhabitants know nothing of its glorious past. Some of them had heard of Columbus; some remembered that it was said he sailed hence to America; but there was no memorial of him here, and I must see the *cura* to know more.

I waited an hour for the *cura*, the parish priest; but he was still less interested, and knew less of the subject I had at heart than the people. He was newly-arrived, busy with affairs of his parish, and I must excuse him; but he gave me permission to photograph the church and to ramble over the premises to my satisfaction. The sacristan, fortunately, was a gentleman and a schoolmaster, who knew something of history, and took a sympathetic interest in my mission. But he declared that there was no memorial of Columbus, and no manuscript, ancient or modern, in or about the church.

Now, this Church of San George is the veritable one in which Columbus read the commands of the King and Queen of Spain to the astonished people of Palos. Four hundred years have passed since then, but it stands to-day, doubtless, as it stood then, a simple church of stone guarding the entrance to the town.

I photographed its eastern façade and also its rear, where is a Moorish doorway draped in vines. As no services were going on, the great doors were thrown open, and I made some exposures of the interior. It is plain, severe, with few pictures, few images; but there is one thing here historic, and which may date from ante-Columbian days. This is a wooden image of St. George slaying the dragon. Sixty years ago, Irving saw this same saint, in the act of slaying this same dragon, and he particularly mentions that both had been recently repainted, and that the nose of the saint was rosy-hued as the sunset. It is, even now, as gorgeous as ever, and the nose almost bright enough to guide the dragon in striking at its tormentor in the dark.

As Saint George occupied a corner so dark that I could not obtain a photograph of his cheerful face, the sacristan and his little son obligingly trundled him out to a position near the doorway, and even offered to do the same by any of the images I might wish to secure pictures of. It was with reluctance that I left the church and turned my face towards Moguer, but the day was nearly ended, and the boy and the burro were impatient to be away.

Don Pedro, of the inn, received me with a good supper, with fruit of his garden and wine of his vineyard. It was quite dark, near nine o'clock in fact, when he invited me to go forth with him and see the town. His good *esposa*, the mother of his children, a jolly woman and comely, pounced upon us as we reached the *puerta*, and proceeded to give Don Pedro a rating. For, doubtless, she had seen the wink he had tipped me, and she knew of his wont in times past, "You are not to lead this señor *caballero* out of his way, remember; he does not want any *señorita* nor any *viuda* to cross his path, for he is too serious, and will make no foolishness." Don Pedro protested that he was only going to take me to the cathedral to see the paintings, and then to the convent chapel of the Puertocarreros. His wife eyed him sharply, but finally sent us away with a *vaya*, and a caution to me not to trust her husband too much, for his heart was greater than his discretion.

My guide was true to his promises, and led me only to places such as the tourist might like to view. In the cathedral, truth to tell, he did slip up behind a pillar and surreptitiously squeeze the hand of a kneeling damsel in black, whose mantilla-shaded face was like marble, and whose lips moved devoutly during it all.

"*Hombre!* what would you?" he demanded, in answer to my chiding, after the event. "Was she not there on purpose, and is she not the prettiest girl in Moguer? To neglect an opportunity like that would be to fly in the face of Providence, and I should hate myself forever after!"

"But what good, Don Pedro, to press the hand of a stranger whom you may never see again?"

"True, you may think so, but she liked it; and as to seeing her, that depends upon the answer she returns *to the note* I pressed into her palm! Ah, light of my soul, how can I wait till the morrow comes?

"But come, I see you take no interest in the daughters of Spain. True, indeed, they are small game, are women, to a man with a purpose. As I said before, Columbus was a great man, and a worthy, but he is dead and these fair children are alive! I like not dead things, let me live my day!"

He then conducted me to the house of the Pinzon family, still in possession of a descendant of the great Pinzon who sailed with Columbus.

Over the doorway their coat-of-arms, but no more, could I see, because the owner was absent. I understood my guide that the present owner held the place of admiral in the Spanish navy. It was not my good fortune to be entertained as Irving was, by a descendant of the Pinzones. I think I should have valued that honor more highly than any other in Spain, for it was to the two brothers, Pinzon, that Columbus was indebted for success. When he came here, penniless, without authority, they were prosperous citizens, men of influence over their neighbors, and we all know of the part they took in that eventful first voyage, furnishing money, men and vessels. Even the royal proclamation, when read in the Church of St. George, was of less avail than their brave example. Hardly treated, as they were, by Columbus and Ferdinand, yet posterity will not refuse them their meed of honor. The needy adventurer, who forgot their noble friendship after his success was won, has left no descendants direct, but the sturdy Pinzon stock still flourishes in its native soil.

Next we went to a convent church, Santa Clara, where Columbus and his sailors performed their vows after the return from the first voyage. You will recall, that they promised, if the Virgin would save them from the storm that threatened to destroy them, they would spend their first night ashore in prayer, in this very church of Santa Clara. Columbus, at least, fulfilled his vow, kneeling here all night before the altar. As the church was then it is now, with a magnificent *retablo*, fine statues and paintings It was erected by the Puertocarreros, whose tombs and whose marble effigies lie in niches on either side. They were a noble family. It was a Puertocarrero, you will remember, who was entrusted with the first vessel from Mexico, New Spain to Old Spain, 1519, bearing the rich treasure sent by Montezuma. It is my misfortune to have come here after one so talented as Irving, who has described this church, and the impression received from its gleaming marbles and the associations of history, in language I would gladly command were it possible.

I can only refer you to his pages, assuring you that his description is correct, and that the lapse of sixty years has made no change in Moguer, nor in the church where Columbus knelt in prayer an entire night on its cold marbles.

Frederick A. Ober.

Revising the New York Building Laws.—A Committee on the Revision of the Building Laws of New York City will hold meetings on each Monday, Wednesday and Friday, during November, in Room 701, Mutual Life Insurance Company Building, 32 Nassau Street, from 3 to 4 o'clock P. M., for the purpose of receiving suggestions from persons interested.

ARCHITECTURE FROM A FIREMAN'S POINT-OF-VIEW.

Belfry at Freiburg. From *Architektonische Rundschau.*

IT is universally acknowledged, theoretically at all events, that it is well for all of us on occasion to see ourselves as others see us; and on this principle it is not unreasonable to consider how buildings and building operations are regarded by those whose special business it is to provide for their protection from fire. The recent issue of new editions of two small works on this subject by the commanding officer of the London Fire Brigade,[1] offers a tolerably complete presentment of the fireman's view of building. It is a somewhat curious study for those accustomed to regard buildings in regard to architectural effect or to their provision for comfort as habitations, or their convenience for the carrying on of business, to go through a treatise in which buildings are regarded entirely in reference to their possible behavior if set on fire; and perhaps the architect, on his part, may find something to criticise in the recommendations of the fireman, over and above the general criticism that, after all, but a small proportion of buildings that are erected are actually burned, or even stand much chance of being burned (theatres excepted), and that, therefore, the provision against danger from fire cannot be allowed to override too much the immediate objects of architectural effect or practical convenience for working.

On the other hand, it must be admitted that the consideration of buildings wholly in regard to their probable behavior under fire leads the author of "*Fire Surveys*" to incidentally touch on some defects in structure which are equally defects apart from any contingency of conflagration, but the mischief of which is specially illustrated and emphasized under the action of fire. In respect to such points the Biblical phrase, that fire shall try every man's work, assumes a new significance. The importance of having a solid foundation and basing a wall properly upon it is certainly emphasized by the dictum of a writer of such long practical experience in the ways of buildings under fire, that the principal cause of walls "tumbling about" in a fire, thereby additionally endangering the lives of the firemen and adding to the difficulty of dealing with the fire, is in almost all cases traceable to the want of proper foundation. And in connection with this subject the author has some bitter remarks to make in regard to what he calls the "mysterious, unsatisfactory, and most expensive process known by the vague and unmeaning title 'underpining.'" The word, for that matter, seems to us to express its meaning well enough, nor is the process by any means necessarily either mysterious or unsatisfactory; but we have no doubt that there are not a few cases in which it is, in Captain Shaw's words, "nothing more or less than a trick or device to hide what is in every case at least a damage, and, as all firemen of experience have frequently and bitterly experienced, in many instances an imminent and serious danger." The ordinary builder and his foreman no doubt attach a kind of superstitious reverence to what they call "underpinning," which with them often amounts to no more than curing a bad foundation by carrying a wall farther down into one which is no better. It is like the elephant of Hindu mythology which stands on the tortoise, while there still remains the question, What does the tortoise stand on? Captain Shaw's fling at "this process, or trick, or device" will do good if it leads any building owners (or builders) to consider the matter a little more philosophically, and to reflect that the supporting wall introduced below is not necessarily any firmer basis unless it plants its foot in turn on a firm foundation. But if that firm foundation be secured either by coming down to rock or other firm natural bed, or by adequately-executed concreting, there is no reason why underpinning should be a delusion. We quite agree, however, that to underpin a single building of a row or block while the rest "is allowed to go on in its natural process of sinking," is only likely to result in unequal settlement of the walls and consequent cracks and further weakening. In such cases, where there is a division of immediate ownership, safety can only be attained by the intervention of public authority; and when our building legislation next comes to be revised, it may be desirable to consider whether any future form of Building Act should not regulate the conditions of underpinning somewhat more in detail, instead of merely requiring a general notice to the District Surveyor or other analogous official. If Captain Shaw's representations bring about more careful attention to this matter of underpinning and its effects on structural stability he will have done good, though it by no means follows that all underpinning is as useless or dangerous as firemen appear to suppose.

We referred the other day to the difficulties experienced at a fire in Melbourne in dealing with very lofty buildings, and Captain Shaw urges the same consideration. The risk of a building is said to be, in general terms, in direct ratio to its cubical capacity: so much more space, so much more chance of something getting on fire, so much more space for fire to develop, and, in general, so much more bulk of material for it to feed on. But beyond a certain height the fire-risk increases also with the height, as the fire-extinguishing and life-saving appliances now available are inefficient or useless above a certain height. This may be added to the reasons already adduced of late for taking some steps to limit the alarming tendency of town buildings to climb higher and higher. At all events, we are told, "persons who erect high buildings should invariably make their own arrangements for getting down externally to spots within reach of the ladders or other means of escape available from outside," and this means to a height of about forty feet from the ground, beyond which height life-saving appliances cannot be counted on at present.

In regard to walls, the fireman will be found to be dead against stone, as the very worst material that can be used in building. As far as the use of stone for so-called fireproof staircases is concerned, this is now matter of common knowledge, and it is in great measure owing to Captain Shaw's representations that this has been brought about; but he comments on the fact that the law still recognizes stone as fulfilling the requirements of a fireproof material for lobbies, stairs, etc., and that incalculable injury has been done by this piece of legislation, which ought to be reformed without delay; for though every competent architect and surveyor knows better now, the fact remains that in London a stone staircase complies with legal obligations, and the surveyor has no power to disallow it; and though every one knows now (thanks, again, mainly to Captain Shaw's former publication of his experiences) that an oak staircase would resist fire far better than a stone one, and remain longer in a safe condition for use in a fire, yet in any public building in progress we are still liable to see the spectacle of the district surveyor solemnly condemning and ordering out a wooden staircase, and demanding the substitution of a stone one, according to law. This is one of the matters which the County Council will be expected to look to before long.

It can hardly be expected that architects will accept Captain Shaw's dictum that "copings, balconies, cornices or other projections should never be constructed of stone, as this material is certain to fall down at an early stage of a fire, and is likely to kill both persons endeavoring to escape and those coming to render aid." This is the fireman's view of architecture with a vengeance: that because a building might some day be burned, and in that case stone cornice-blocks or corbels would fall, therefore all buildings are to be shorn of whatever architectural enrichment and effect is to be gained by oversailing stonework. That is an example of the unreasonableness of specialists, who can see things from no point-of-view but their own. The caution that walls constructed of stone alone are often found to stand better than those of stone with brick backing is more to the point; the different behavior of the two materials under fire may have an even worse disintegrating and twisting effect than results in a wall entirely of stone. Captain Shaw's opinions about the bonding of walls are much open to question. In "*Fires in Theatres*," he remarks (page 6) that "it is a great mistake to have a number of internal walls merely touching the external ones, and not bonded into them or in any way contributing to the support of the structure." Where has Captain Shaw seen walls built thus? From another passage, however, in "*Fire Surveys*," we gather that the fireman's notion of bonding one wall into another is that "an external wall should be firmly tied to party and return walls by strong wrought-iron anchors, of sufficient strength and number to keep the whole of the building firmly fixed without the assistance of floors, roofs or internal ties of any kind." The fireman's great desire is that the walls should be independent of floors, so as not to collapse when floors fall in, and he wants to be sure that the front wall will not part from the cross-walls during fire. Now, if we were providing for a building which was probably to be burned in a year or two, Captain Shaw's "anchors" might be accepted as an additional security against the parting of the walls; but as, after all, we construct buildings with the intention that they shall last many years and *not* be burned, we should object to the "anchors" as introducing an element of decay into a structure otherwise of permanent materials. Captain Shaw is alive to the danger of wood bond, but sees none in hoop-iron bond or in his proposed "anchors"; but iron is always an element of decay in a wall, and, besides, if the wall gets greatly heated in the fire, the iron within may itself get heated sufficiently to act as a destructive agent in cracking and twisting the wall. Ordinary brick bond may, no doubt, be insufficient, from the fireman's point-of-view, between walls meeting at right angles; but a stronger bond than the iron anchors, and one not liable to be affected by fire, might be formed by employing long tailing-pieces of concrete every few courses, built in cement into the cross-wall, and with a short cross-head, formed in the same piece of concrete, bedding on the front wall, and even (for greater security) with square joggles formed on the under side to tooth with the courses of bricks. The tensile strength of the concrete blocks would not support the weight of the outer wall if applied vertically, of course, but it would be ample to prevent the wall settling out of the perpendicular and away from the cross-walls in the first instance, and it would form a permanent element of strength in the wall. That is how we should provide against the fireman's dread of the walls parting, and he might go safely on brick walls thus bonded. But metallic bond is

[1] "*Fire Surveys, or a Summary of the Principles to be Observed in Estimating the Risk of Buildings.*" By Captain Eyre M. Shaw, C. B., London Fire Brigade. Third Edition. London: Effingham Wilson & Co., 1889.
"*Fires in Theatres.*" By Eyre M. Shaw, London Fire Brigade. Second Edition. London: E. & F. N. Spon, 1889.

mainly the resource of careless and cheap building: scamp the wall, and then tie it up with bandages. No good comes of that.

In reference to this question of stability of walls, Captain Shaw wonders why strength in a long wall is not oftener sought by building it on a zigzag plan. There are many cases, he thinks, "in which the loss of space, loss of material, expense of construction and inconvenience of approach would be much less with a thin, zigzag wall than with one of those massive, costly walls so commonly found, with enormous buttresses blocking up approaches and occupying space." Probably the principal reason against it is that, in spite of the opinion expressed in the above quotation, a wall so built would be regarded by most people as ugly externally and inconvenient internally. We knew of one instance of this construction being employed in the side of a large saloon, by a gentleman who was "his own architect," in a building which actually was burned, and where Captain Shaw and his gallant band "assisted" at the catastrophe, but how that wall behaved under fire we did not learn. The idea, however, is one to be kept in mind, for it may be convenient in some situations, and, moreover, it has its architectural possibilities. In regard to the relation between floors and walls, the fireman's view is that floors should be quite independent of walls, and he is apparently as anxious that floors should *not* be bonded into front-walls as that cross-walls should be. As long as the floors are of materials inflammable or liable to be twisted or injured by fire this is quite right; they must come down, and in coming down they tend to pull the walls down. But with floors which are as fireproof as the walls (and floors can certainly be made so now), the building of the floors into the walls ought to be a great source of strength to the whole structure in fire. But the whole matter of fireproof floors is passed over in this recently-published new edition of Captain Shaw's book with the most extraordinary indifference. There is a great deal said about the various species of wall that stand fire best, but little or nothing as to the various important forms of fireproof flooring which have been brought out of late years, on which the opinion of the fireman might be of value. We are urged to arrange buildings so as to "divide the risks" as much as possible; *i. e.*, to divide the building into separate compartments, so that fire beginning in one of these cannot easily spread to another; but all this is said apparently in relation to horizontal division only, and the immensely important aid in subdividing risks which may be afforded by fireproof floors built into the walls is practically ignored. This looks as if the production of the new edition of the book had been carried out in a somewhat perfunctory manner, and without much trouble to bring it up to date in regard to the present possibilities of fire-resisting construction. The new edition of "*Fires in Theatres*" seems to be similarly not brought up to date. There is a great deal in it as to the possibility and importance of shutting off the stage section from the auditorium, and about the arrangements to be observed in the stage section for minimizing fire-risk; but there is no reference whatever to the absolutely new construction of several theatres lately with incombustible materials in the auditorium—an important move in the direction of fire-resistance (whether best for acoustics is a separate question) which seems really to have escaped Captain Shaw's notice. At all events, he practically ignores it.

It is worth note that the author states that, when it is impossible to fix iron doors to cut off communication, light revolving iron shutters, which can be drawn whenever the opening is not in use, are a considerable check to the passage of fire, and worth fixing with that object. In reference to iron, it is stated as a matter-of-fact and experience that solid iron columns are much more capable of resisting the effect of heat than hollow ones, a result which we should think by no means improbable; but which need hardly be regarded as affecting the usual form of construction of cast-iron columns, inasmuch as no one who knows what he is about would now depend on iron columns of any make in a building which he wished to regard as fire-resisting. The at first sight rather extraordinary recommendation that "circulation of air should on no account be permitted in any part of a building not exposed to view, especially under floors," etc., means really, we presume, that there should be no concealed spaces; an opinion we expressed not long since on sanitary grounds; and we find that Captain Shaw, from this point-of-view, is as critical as we were, for slightly different reasons, in regard to the evil of leaving between the roof and the ceiling "a large space to which access is difficult, and which may consequently conceal the elements of danger until they become serious"; a sentence as true in regard to danger from fire as to danger from accumulations of unhealthy matter. "It is difficult to understand," Captain Shaw sarcastically adds, "the principle on which those persons act who, after constructing and covering-in for themselves a building of a certain size, deliberately deprive themselves of the use of a large portion of it." The principle on which they act is the principle of the truss; and there are cases where, while this principle is constructively necessary for spanning the space, it is not convenient, either as regards warmth or appearance, to leave the roof open to the rafters; but we entirely concur, and have already expressed our strong opinion, that these roof-spaces should always be easily accessible, and sufficiently lighted to see what is going on there. In most cases they could be turned to practical use with but little extra expense.

A great portion of "*Fires in Theatres*" is historical, and in that sense of considerable interest, though not exactly coming into the scope of this article; and, of course, a good deal of the ground in regard to fire-resisting construction is covered by the general recommendations in "*Fire Surveys*." In regard to other considerations, two or three points present themselves as prominent. One is the employment of firemen in theatres, in regard to which Captain Shaw rightly condemns, and contemns, the device of merely dressing an ordinary workman in a special costume and calling him the fireman; but he is rather inconsistent in his recommendation as to what should be done. He says he has pointed out to managers three courses: (1) the attendance of a staff of public firemen at the managers' cost; (2) the permanent hiring of properly-trained men to act as firemen; (3) the appointment of skilled firemen to confidential posts in the theatre—killing two birds with one stone, in fact. But almost in the same breath he admits that the cost of the two first systems is prohibitive, and all he can say for the third is that there are objections to it on the part of managers which "ought, if possible, to be overcome." In regard to fire-resisting metal curtains between the audience and the stage, the author rightly says that "in the present state of mechanical skill and knowledge it is simply monstrous to say that the thing is impossible"; that it is easy to make and fix a curtain that fire would not get through for an hour, more than time for saving the audience. Such a curtain should, in our opinion, be down before the opening of each performance, so as to ensure that it is in working order; it need not be used for the acts; it is sufficient that it is lowered and raised before each evening's performance. In regard to further means of shutting off fire, the author recommends not only the now usual iron doors between the stage section and the auditorium, but iron doors between the auditorium and the lobbies, which latter, with the staircases, should be sufficient to contain all the audience who can be seated within the house. He speaks of the security given by "immediate exit" from the auditorium into the lobbies, with these doors closed behind the retiring audience; but then that word "immediate" raises the question as to the movements of the audience themselves. As Captain Shaw says, if one man at the top of a theatre heard an alarm of fire he would run down and save himself easily, and "at first sight there appears no particular reason why a great many should not be able to do so as well as one." The difficulty is not only in the tendency to excitement, which Captain Shaw refers to, but in the fact that the movements of a heterogeneous crowd are not even or rhythmical. If they could, under any word of command, assume a uniform pace and formation, they would be out nearly as quickly as one man. We remember much admiration being excited by the manner in which the commander of a company of volunteers got his men into the train one year for the Easter review. The men were formed four deep and halted parallel to the train; at a word of command each alternate rank entered a carriage and occupied the front seat; at a second word the remaining fours entered and occupied the back seats. Two or three hundred men might be got into a train well under a minute in this way; the same number as an irregular crowd would be twenty minutes over it. However, we cannot apply discipline to a heterogeneous crowd on the instant. Captain Shaw's proposal for breaking up long passages by barriers, at such distance as would include fifty people between each, is a kind of step in the direction of an enforced discipline; one person only being able to pass at a time, there could be no great and increasing pressure in any section. There would be a great deal of grumbling at the barriers under ordinary circumstances, and it may be argued that in a fire they would be a serious impediment to quick exit; but the supposition is that the theatre is so constructed as to leave plenty of time, and the real danger then is from a rush. We commend to the builders of theatres Captain Shaw's remarks on staircases; on the use of handrails, in passages as well as staircases, as affording a chance of checking a rush and preventing falls; on the value of turns in staircases, and the danger of a long straight staircase, a feature to be found in some of the most recent and advanced theatres, and which we have always regarded with suspicion.

The theatre book, in spite of the omission to take into account the latest manner of construction, as an admirable one. But we think that "*Fire Surveys*" required a good deal more re-editing than it has received, and that before another edition is called for the author might do well to discuss some of the matters referred to with those who have more scientific knowledge of construction than he would probably lay claim to. — *The Builder.*

RESTORATIONS IN ITALY.

THE preservation of the antique character of the Italian cities seem to be of so much less importance to their inhabitants than to outsiders that it is highly probable that, if the municipalities only were to be consulted, the limits of renovation would be the ability to raise money. The power exercised by the archæological authorities is applied with as much energy as discretion, and it is quite sufficient for the Ministry to be informed by any responsible person that a monument is threatened to have an inspector of antiquities sent to examine the case and stop any injury to it. In this way the scouring of the sculpture on the Duomo of Florence was

stopped on the warning of the *Cornhill Magazine*, to the intense indignation of the *bourgeois*, who hoped to see the whole exterior of the church as bright as a bride cake. I was able in this way to stop the destruction of the *quadrivium* of Giovanni Pisano at Rieti, which was in the way of widening a street, and to stop the renovation of the pulpit of Donatello at Prato, which was already in the hands of the scraper.

The large cities have been for the last few years in a fever of *sventramento*, opening up, and certainly in some cases it is not only justifiable, but demanded by the most imperious sanitary considerations. In Naples, for instance, it can hardly be carried too far, as in the architecture of that city there is almost nothing worth preserving; but the fever has spread to Venice and Florence, where immense injury might be caused by the operations of a modern engineer.

The plans in Venice included a broad street from the railway station to the Piazza S. Marco, and the demolition of all the picturesque Riva from the Riva dei Schiavoni to the public gardens, and the construction of fine modern buildings along the whole line. The latter part of the project brought the whole body of artists, Italian and foreign, up in protest, as, without its artistic attractions, Venice would be in a more miserable state than it is now, the clamor raised in behalf of this remnant of the old Venice which furnishes half the pictures painted there, stopped the measure in the Council after it had gone through the Giunta, or Grand Committee; but the other, for the wide street, passed without serious opposition. It will be a satisfaction to us to know that the Government refuses its consent to this invasion on the unique character of the city. Venice needs no *sventramento*, but it would be the better for a little cleaning in some of its historical precincts, such as the court of the house of Marco Polo, and the covered way that gives access to it from the canal, which is generally in a pestilential state. But any demolition, except for instability, would be sacrilege.

As to Florence, one is apprehensive of the effects of any touch on its time-honored walls. But neither sea-air nor sea-tide does for it what it does for Venice, and the tendency to typhoid, which has caused trouble to its sanitary authorities and loss to its finances, demands the adoption of measures to prevent it.

What has been decided is to demolish the entire block between the Via di Porta Rossa on the south and the Via dei Cerretani on the north, the Via dei Calzaioli on the east, and the Piazza degli Strozzi on the west; to enlarge the Piazza dei Mercato Vecchio to double its present extent, reaching as far as the southern limit of the Piazza S. Andrea; then running wide streets from the Via dei Speziali to the Via dei Strozzi, Via di Or S. Michele to Vicolo dei Strozzi, Via della Nave to the Via dei Corsi; and from the Volta dei Pecori to the Via Tornabuoni, through the Via Teatina, and across these others from the Piazza S. Maria Maggiore to the Torre de Foresi, Via dei Naccioli to the Via di Pelliceria, and from the Palace of the Arcivescovate to the Mercato Nuovo. But the houses on the Via Calzaioli and all the historic houses will remain undisturbed and all the old houses on the Via di Porta Rossa. These will all be disengaged from the more modern incrustation in which most are hidden. The Loggia of Vasari in the Mercato Vecchio has been taken down and will be reconstructed in the vicinity of the new fish-market. The *risanimento* of the "centre" of Florence can raise no reasonable alarm in the mind of any lover of the city, though the work of reconstruction must be carried out with great judgment to avoid the disfigurement of it. The sanitary advantages leave no room for discussion. At the same time nothing really worth preserving, historically or architecturally, will be disturbed, but will, on the contrary, be better seen by being insolated more. — *London Times.*

SOCIETIES

THE DETROIT ARCHITECTURAL SKETCH CLUB.

THE last competition of the D. A. S. C., — for a newel-post, hand-rail and balustrade in hard-wood — known as the "Scott Competition" (for the reason that Architect John Scott offered prizes to successful competitors) was awarded as follows: R. Mildner, 1st, A. Kalm, 2d, and Max Grylls, 3d.

The next competition will be for a set of Hardware for a door, for which Messrs. Hopkins & Dickinson offer cash prizes of $15.00, $10.00, and $5.00.

At the next regular meeting the subject of drainage will be discussed.

Very respectfully, C. A. FULLERTON.

SHORT FACTS ABOUT ALUMINIUM. — After being cast, aluminium has about the hardness of pure silver, but may be sensibly hardened by hammering. Its tensile strength varies between 12 and 14 tons to the inch. Comparing the strength of aluminium in relation to its weight, it is equal to steel of 38 tons tensile strength. The specific gravity of cast aluminium is 2.58, but after rolling or hammering this figure is increased to about 2.68. — *Journal of Commerce.*

COMMUNICATIONS

[*The editors cannot pay attention to demands of correspondents who forget to give their names and addresses as guaranty of good faith; nor do they hold themselves responsible for opinions expressed by their correspondents.*]

BLUE-PRINTING ON A WHITE GROUND.

LOS ANGELES, CAL., October 29, 1889.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Would you kindly inform me in what number of the *American Architect* appeared a process of blue-printing by which a blue line was produced on a white ground. If you can give the information you will confer a favor on

Yours respectfully, GEORGE M. THOMSON.

[ONE of several methods will be found described on page 58 of the issue for August 1, 1885. — EDS. AMERICAN ARCHITECT.]

THE SUPERVISING ARCHITECT.

EAST GREENWICH, R. I., November 11, 1889.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you please inform me who is the head of the Architectural Department at Washington.

Yours truly, H. B. INGRAHAM.

[MR. JAMES H. WINDRIM, F. A. I. A., of Philadelphia, is Supervising Architect of the Treasury Department. — EDS. AMERICAN ARCHITECT.]

BOOKS.

BROOKLYN, N. Y., November 11, 1889.

TO THE EDITORS OF THE AMERICAN ARCHITECT:

Dear Sirs, — Can you inform me of the best works on stereotomy and stone vaults and groinings? Respectfully yours,

R. B. EASTMAN.

[PROBABLY the best thing you can consult is Viollet-le-Duc's "*Dictionnaire.*" Articles "*Voute,*" "*Construction,*" "*Coupe de Pierre.*" C. E. Greene's "*Arches in Wood, Iron and Stone,*" published by John Wiley, of New York, at $2.50, is standard; so, too, is Dobson's "*Masonry and Stone-cutting.*" — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

OLD LONDON BRIDGE. — The first stone bridge across the Thames at London was commenced in 1176. The architect was Peter of Colechurch, who died in 1205, one year before the structure was completed. The stone platform was 926 feet long and 40 feet wide. The coping stones were 60 feet above the level of the water at ebb tide, and the bridge was formed by nineteen pointed arches, with massive piers from 25 to 34 feet in solidity, having a draw-bridge on each side of the river to protect the approaches. The chapel inscribed to St. Thomas à Becket consisted of two stories and was familiarly known as St. Thomas of the bridge. It stood on the tenth or great pier, that is, as nearly as possible in the centre of the bridge, the lower portion being the crypt, paved with black and white marble. In this crypt the architect, Peter of Colechurch, desired that his bones might rest, and there, it may be presumed, they peacefully remained for centuries. But in 1737 the premises came into the occupation of a Mr. Yaldwin, to be used by him as a dwelling and warehouse. While alterations were being effected under the staircase of the crypt the remains of a human body were discovered and removed, but no inscription was found to afford a clue as to whose body it was, nor were any records of the interment forthcoming. In the summer of 1883 old London bridge was removed. I was at school in Kensington at the time, and hearing that the crypt which once contained the remains of Peter of Colechurch had been discovered I hastened to view the ruin. Admission to inspect was denied to a boy, albeit of archæological proclivities, and I was fain to watch the process of demolition from the nearest buttress of the London bridge now standing. However, I secured a print, which I still retain, showing the chapel of St. Thomas and the crypt let to Mr. Yaldwin in the last century. The questions, therefore, remaining to be solved are: 1. Who completed the old bridge when Peter of Colechurch died in 1205? 2. Of whom were the remains discovered in the tomb under the crypt stairs in 1737, and where were they afterwards placed? — *St. Louis Post-Dispatch.*

THE "JERRY-BUILT" HOUSES OF ROME. — On the outskirts of the Ghetto a long street led to the Portico of Octavia, where Titus celebrated his triumph and Syrian captives bore the spoils of the temple in his train. Close by the colonnade of this noble ruin the ancient fish-market, which had been held here for centuries, might still have been seen a year or two ago. The sight was strikingly picturesque. The many-storied houses of the narrow street almost shut out the blue sky overhead, and the sunshine streamed through the meeting roofs on the glittering scales of fish and the worn marble slabs which had been in use since the days of the Cæsars. A few steps farther on was the theatre which Augustus built in honor of the young Marcellus. Here we were met by another of those strange contrasts over which Ampère

loved to moralize. Under the Doric arches of the lowest tier artisans had their shops, and the ruddy light of the forge glowed upon piles of green vegetables and watermelons and joints of meat which dangled from the travertine blocks of the Augustan age. Above the Ionic arches of the upper story rose the grim walls of the Savelli Palace, built in the Middle Ages on a lofty heap of débris within the theatre. This was the home of Niebuhr when he lived in Rome as Prussian Ambassador. From these windows he looked down on the fountains, the orange trees, and flowering jessamine of his little garden, and far away across the Tiber to St. Peter's and Monte Mario. This district has undergone a thorough cleansing. The ancient fish-market and the shops have been removed, and the Ghetto levelled to the ground. Whole streets were carted away last year amid clouds of white dust and mortar. Only the fortress-looking walls of the Cenci Palace, the Portico of Octavia, and the Theatre of Marcellus remain, isolated and stripped of their surroundings. In short, the whole of this remarkable quarter has disappeared to make room for more boulevards and "jerry-built" houses. — *The Nineteenth Century.*

New Device for scouring away River Bars. — Several models of a new boat, built on the jetty plan for the purpose of washing out bars and new channels in the river, on exhibition at the Planters' House, in this city, are the source of much interest and enthusiastic comment by river men, who have taken especial pains to investigate the feasibility of the new candidate for Government favor. The affair is the invention of Grant Marsh, of the towboat "*R. A. Speed*," and has received such universal indorsement that St. Louis capitalists have taken the matter in hand, organized a company, and will put the scheme before Congress with a view of its adoption by the Government for future river improvements. The model represents a boat 300 feet long, 25 feet beam, 10 feet hold, constructed entirely of iron and containing a series of compartments, each provided with pumps. The machinery for motive-power as well as for the pumping-apparatus, being located directly amidships. The boat has no model, in the general acceptation of the term, but is the same depth of hold its entire length, being pointed at both ends, leaving probably 200 feet of straight hull. The operation consists in sinking one or a series of the boats, as may be necessary, at the point above the bar or channel to be scoured, where they remain until the new channel is complete, when they are pumped out and taken to other fields of operation. Upward of 100 steamboat men have examined the models in the past few days, the general verdict being that its adoption by the Government will completely revolutionize the present system of river improvement. Models will be shipped to-morrow from here to Louisville, Cincinnati and Pittsburgh. Capt. Grant Marsh, the inventor, is naturally highly elated over the prospects of his pet scheme, which he has covered with a patent. — *St. Louis Globe-Democrat.*

Cremation in France. — It will certainly take a considerable time before the French become familiar with the system of burning instead of burying their dead; but cremation may, nevertheless, now be said to have a recognized position in France, and to render a cremation popular — at all events with the humbler classes of society — everything has been done to make the process cheap. The Prefect of the Seine has just given his sanction to a tariff for burning the remains of persons who may themselves, or whose relations may, prefer this system to burial. A uniform and moderate charge of 50 francs is made, this including the right of depositing the ashes in a columbarium which will shortly be built by the city of Paris, and leaving only the urn, in which the said ashes are enclosed, to the cost of the relatives. Moreover, in the case of persons who are certified by the mayor of the commune in which they died to have been in very necessitous circumstances, no charges whatever will be made for cremating their remains, or for keeping, during a period of five years, what remains of the body after the burning process. Nothing is said as to what will become of the ashes at the expiration of the five years; but probably, as the bones of the dead are now every three, five or ten years, according to the length of lease of the ground, removed from cemeteries to the catacombs, so the ashes will be collected and placed in some general receptacle. — *London Standard.*

The Fate of One of John of Bologna's Works. — There is something about professors and clergymen which makes them particularly prone to consider themselves experts in criticism of the fine arts, and produces dire effects in colleges and churches. One of the most flagrant instances occurred a half-dozen years ago at Oxford. The front quadrangle of Brasenose College had as a decoration a group of fighting gladiators, one of whom has the other down on one hand and his knees, while he draws off to strike the almost prostrate foe. It was not in a costly material, being of lead, but it happened to be the only work of its kind by John of Douay, who in Italy, his adopted country, went by the name of Giovanni da Bologna (1524–1608). It will hardly be believed that the master and fellows of Brasenose sold this monument for old lead to a plumber, who melted it down for water-pipes! It is difficult to conceive of the mental condition of these worthies. Even if they saw no beauty in the figures and wished the group out of sight, one might have expected them to have enough interest in the monument as a piece of history connected with their college to preserve it in some less conspicuous place. But they bundled it off; into the melting-pot it went. — *N. Y. Times.*

A Heavy Bellite Blast. — It is stated that a heavy blast has recently been carried out with the explosive bellite in connection with the Westport Harbor Works, New Zealand. It was desired to dislodge some 1,800 tons of rock, the mass being loose on three sides. A tunnel was cut about 15 feet into the rock, and chambers were formed to the right and left for a few feet at the end. In one of the chambers thus formed a charge of 125 pounds of bellite was placed, and in the other a charge of 75 pounds, making a total of 200 pounds. The report of the Government engineer of public works shows the blast to have been most successful. The shot, when fired, not only broke up the whole of the rock desired into convenient masses, ranging from 3 tons to 20 tons in weight, but its effect worked back through a large area. It is computed that, on the whole, instead of 1,800 tons, about 2,200 tons of rock were brought down by the 200-pound charge. This gives an average of 11 tons per pounds of explosive used, which is a very satisfactory result, and much higher than the usual percentage, although it is to be observed that the blast was located in a favorable position. On the other hand, it is stated that a smaller charge would have answered equally well, as the expansion of bellite is slower than that of dynamite. This comparative slowness renders its action more uniform, and distributes the work over a greater area, the action being less local. — *Invention.*

TRADE SURVEYS

One of the frequently-observed characteristics of the present commercial situation is the sure development of reactionary tendencies from any extreme pressure in any given direction. A threatened stringency in money last week is followed, perhaps, this week by easier conditions. Cornering combinations are broken up or disabled by unforeseen influences, which, somehow, dovetail into their contraries. The spirit of organization and of familiarity with the country's manufacturing and commercial needs are largely responsible for this protection. Within certain limits, these counteracting and protecting influences and tendencies can be relied upon by business men, but emergencies and conditions may arise when there will be no reaction, and it is this very feature which money-lending and banking interests are watching. The discomfiture of trusts, though technically, perhaps, due to other causes, is very largely due to the automatic workings of economic agencies. In many parts of the West there are some distressing symptoms of insufficient money, but it is hardly to be wondered at that out of the general rush of agricultural borrowers there should be a growing percentage of failures to make restitution as nominated in the lenders' bonds. Default has been made on large loans among farmers in some Western States, but it does not seem to be widespread. The makers of agricultural implements have, here and there, discovered that they have worked too fast for the cash-paying capacity of the markets they serve. The volume of business, as shown by railroad traffic and bank exchanges, continues at high-water mark, and the general policy of buying raw material away ahead continues. Prices rule high and firm in nearly all avenues. In cotton and woollen products and knit goods, the increased distribution due to cold-weather requirements is giving life to trade in jobbing and manufacturing centres. In boots and shoes, clothing and allied trades, more labor is reported employed than since last winter. Jobbers in the three or four Atlantic coast commercial centres all report extraordinary activity, and travellers speak of unusual activity also in retail circles. There is a more careful measuring of requirements by commercial and middlemen generally than ever before, and this fact gives manufacturers confidence that the demands presented from day to day and week to week are altogether legitimate, and not in the least speculative. Manufacturers everywhere have this sort of faith in demand. A glance at the iron trade shows that demands are expanding and that production is increasing. New blast-furnaces are either projected or under construction in eight States, and since September 1st as many as twenty furnaces have been talked about which it is yet too early to announce as projected. Some of the sites are in Southwestern Virginia and Southeastern Kentucky. The rush of capital southward has not been discouraged by poor dividends, although in some political circles hints amounting to threats are sometimes thrown out in the direction of the repudiation of debts. The new industrial spirit of the South takes no part in such half utterances, and will never permit them to reach authoritative expression.

Measures are now being taken among some commercial bodies in the South to create still more friendly relations with the controllers of Northern capital, and many new and inviting opportunities are soon to be opened. The lumber trade both North and South has been so encouraged this year by the volume of business, if not with the margins, that more winter preparatory work will be done in the gathering of stocks for the demands of the next season. The pushing of yellow pine in Northern markets is largely due to the acquired interests in Southern timber properties of Northern capitalists. The ore-mining interests of Lake Superior have attracted much capital this year, as well as the gold, silver and lead mines of the farther West. Irrigation schemes contemplating the outlay of large sums, and the acquirement of now almost valueless lands, have been about completed. Reorganization schemes affecting railway properties hitherto non-productive seem to be reaching a climax, without a scaling down of capital. Numerous manufacturing combinations throughout the interior are in progress looking to the coöperation of hitherto isolated interests. Railroad-building schemes are still fermenting, with probabilities favorable to the inauguration of extensive new railway-building enterprises. House-builders have thus far this year found waiting buyers for about all the brick-and-plaster shelter they have established. Architects, so far as they have been recently consulted, express an opinion which leans decidedly to another active building year. Building and loan associations are multiplying far away from the scenes of their boyhood, and the impetus which this coöperative system gives is felt in all new rising industrial communities. In foreign industrial centres, or most of them, labor is in better and more constant demand than for years, or, for that matter, since the dawn of the industrial era, and the masses abroad are giving much attention to social and economic questions. Ship lines and cheap travel will do more to remove causes of unrest than all other influences combined. European employers are doing more than American employers to make conditions easy for labor. The condition of wage-earners is becoming more uniform. Small shops and factories have been multiplying at a very rapid rate this year, and it is estimated that the number this year is about double that of last. The equipment and furnishing of these multitudinous concerns helps to make business what it is. While they find work, the larger industries will have no cause of complaint. While crops are good all will be well. Possibly bad crops will never extend all over the United States as they have over the United Kingdom and certain portions of Europe for years, but should crops be generally bad a sudden halt will come to all these booming towns. The equilibrium between shop and farm has been delicately maintained for years, but should Nature knock the scales out of balance, there will be a repetition of past experience in declining trade, wages and general prosperity.

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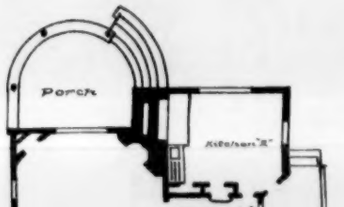
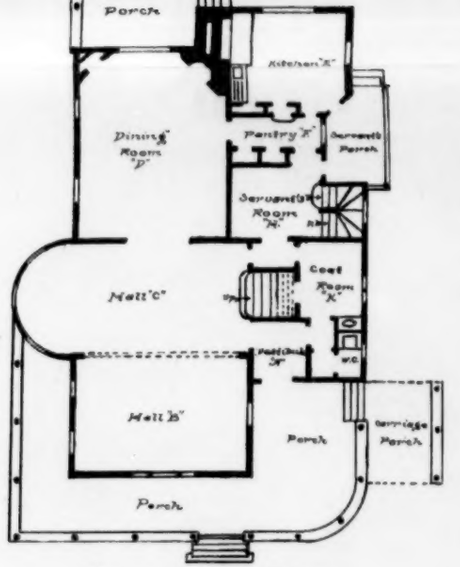


House for
FRANCIS W. KEANEY, ESQ.
AT BRADFORD HILLS, PA.



FIRST FLOOR PLAN.

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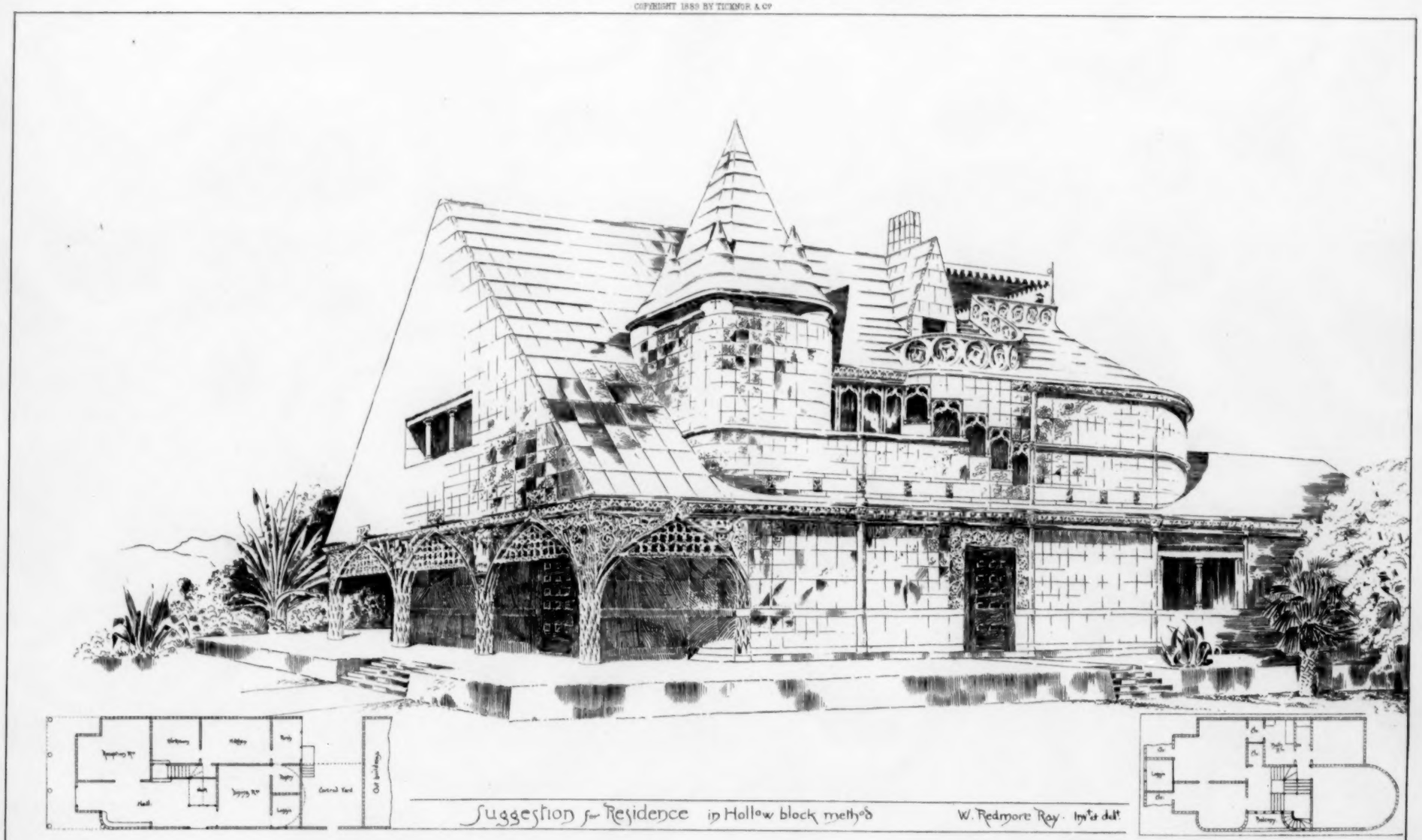

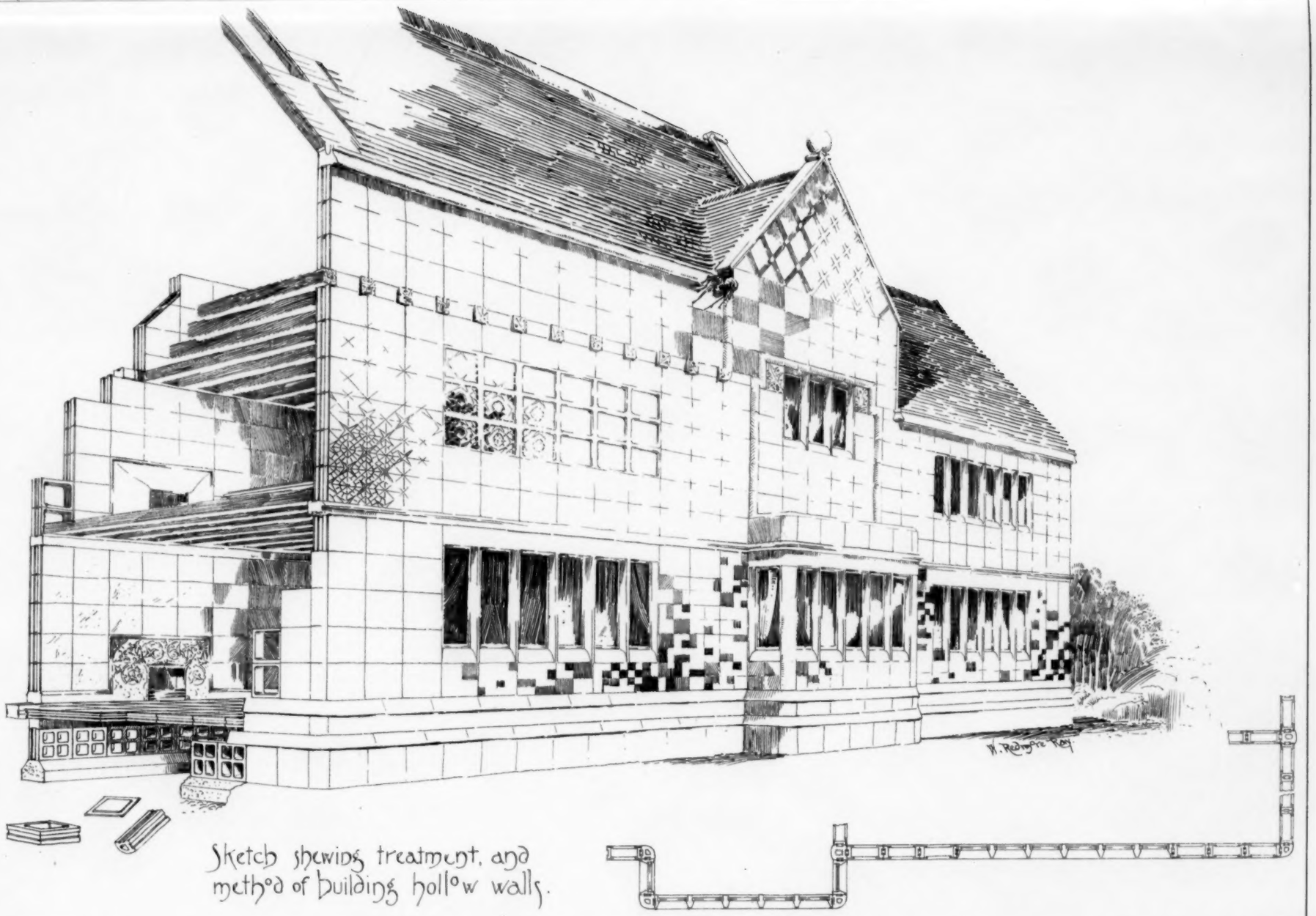

Sketch shewing treatment, and method of building hollow walls.

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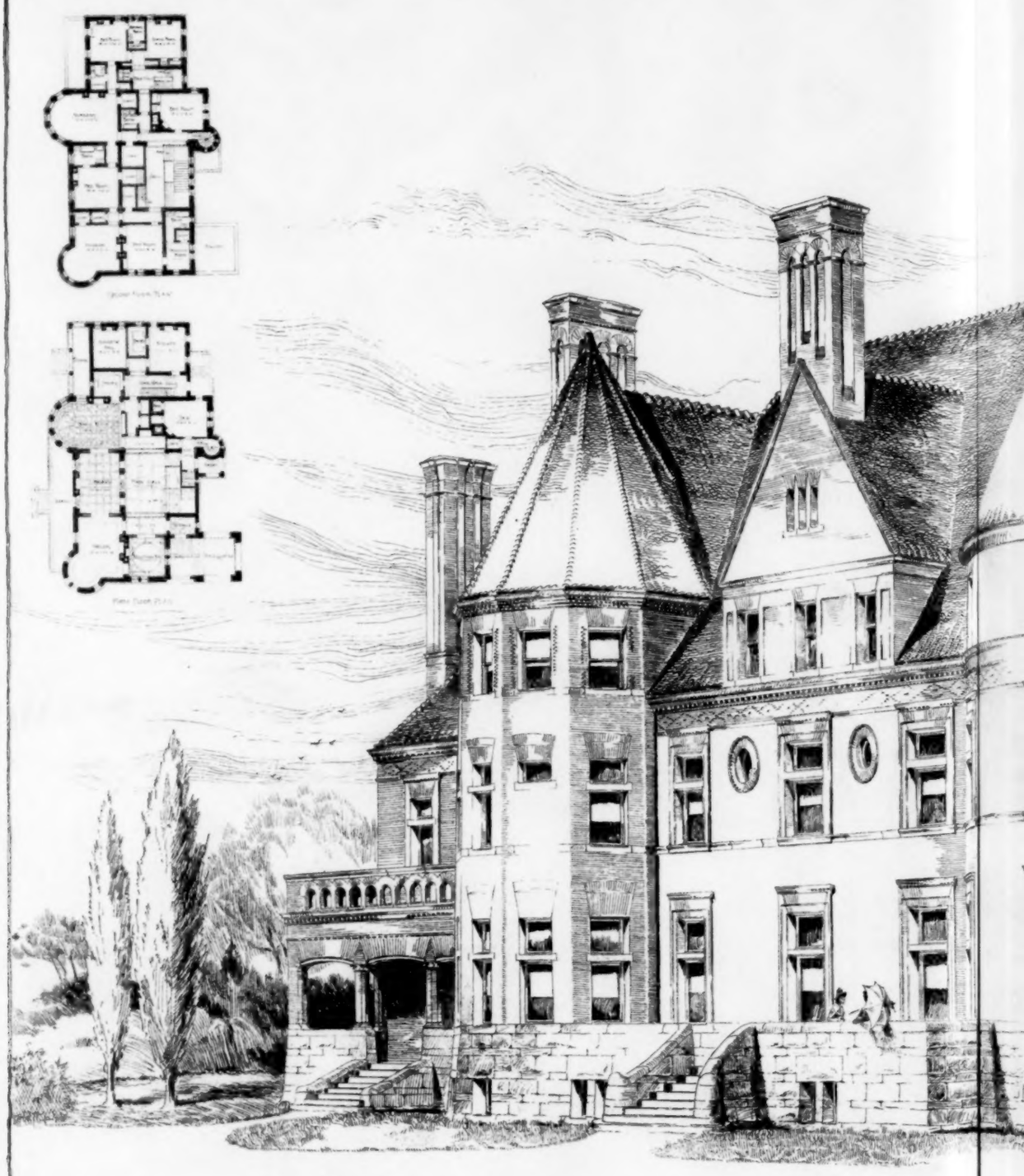

House for Mr. Wm. Hamlin: Buffalo. N.Y.

Messrs. Marling & Burdell. Architects. Buffalo.

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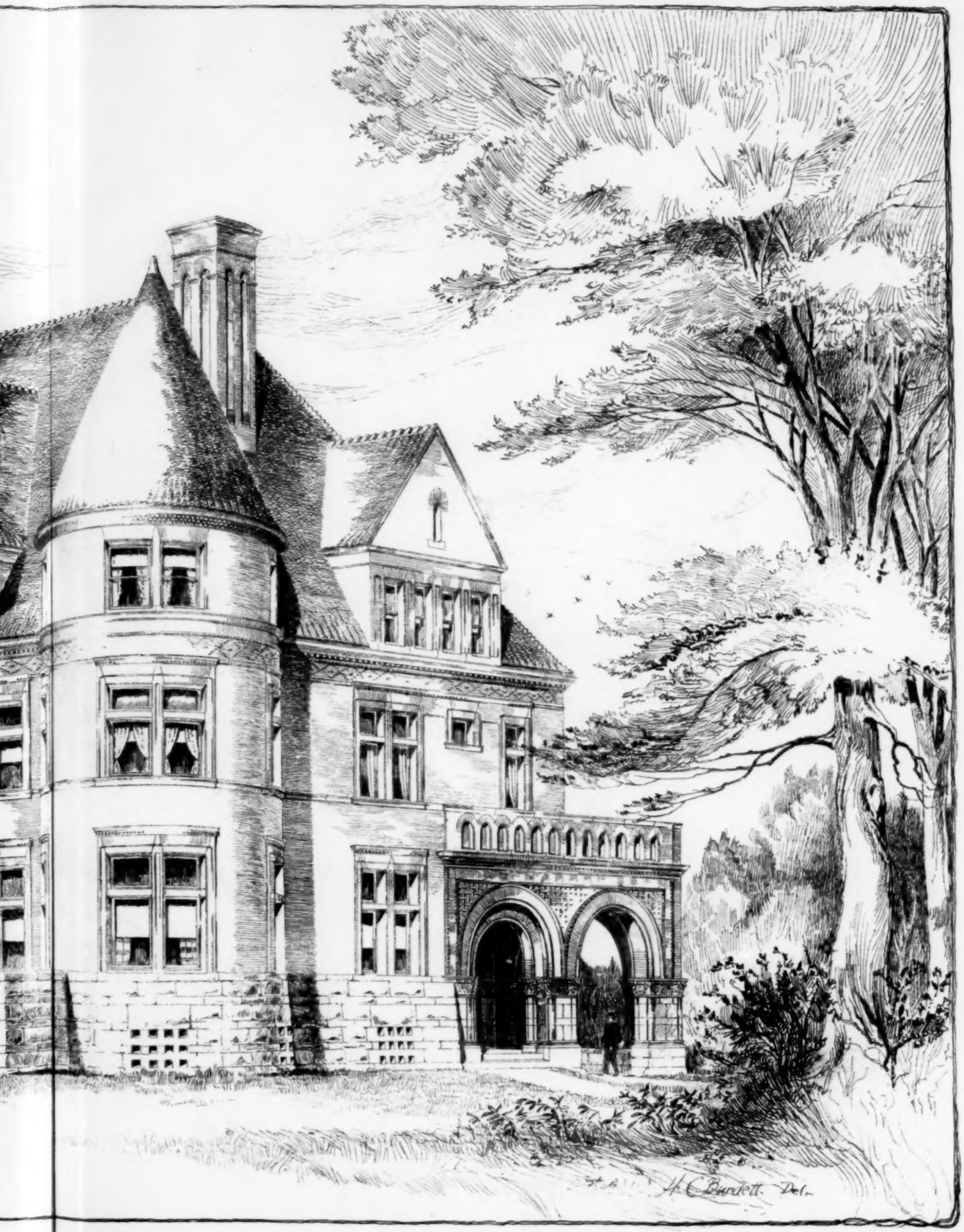

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